

## INCOMING INSPECTION REPORT

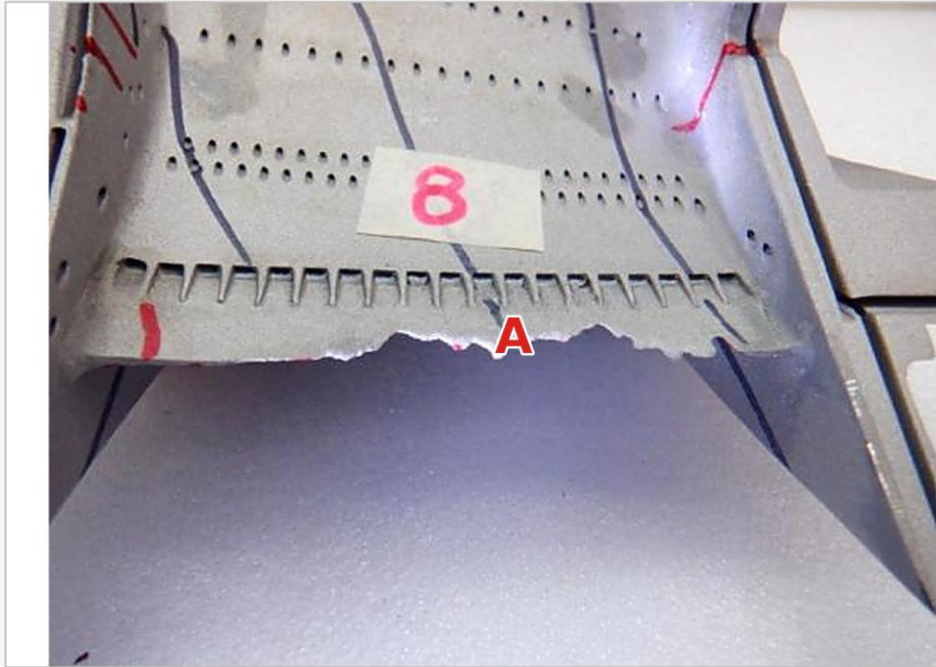
|                        |                                                                                             |                       |                                 |
|------------------------|---------------------------------------------------------------------------------------------|-----------------------|---------------------------------|
| Customer               | Nghi Son Refinery & Petrochemical, LLC.                                                     | Report Date           | 27 April 2026                   |
| Customer P.O. No.      | WO1003986864                                                                                | Component             | 1st Stage Nozzle                |
| Engine Type            | MS6001FA (GE Frame 6FA)                                                                     | Part Number (Ring)    | 143E5711G02                     |
| Part Number (Casting)  | 129E9734 P002                                                                               | Qty. Received         | 24 Segments (1 Complete Set)    |
| Material               | FSX-414 Cobalt Superalloy                                                                   | As-Received Coating   | HVOF MCrAlY + Full TBC Top Coat |
| Repair Classification  | <b>HEAVY REPAIR</b><br><b>Severity Level 9 of 10</b><br><b>(Very Heavy, upper boundary)</b> | Total Emergency Trips | <b>125</b>                      |
| Total Initiated Starts | 476                                                                                         | Breaker Trips at Load | 127                             |

Reviewed and approved  
UNEW Engineering



Paul McGuire, Engineering Manager

## FIG. 11 - TRAILING-EDGE CRACKING / THROUGH-WALL LOSS (ITEM 8)



**ORIGINAL INSPECTION PHOTOGRAPH**



**MAGNIFIED VIEW A**

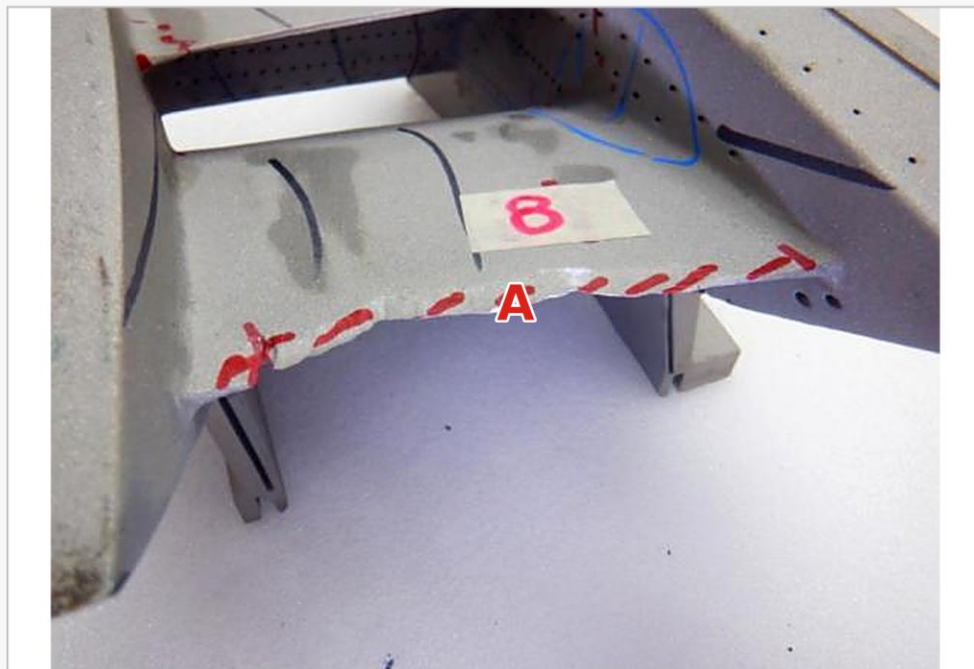
**DOCUMENTED DAMAGE SIZE: 8 x 100 mm THROUGH-WALL LOSS (ITEM 8)**

### **HEAVY REPAIR BASIS**

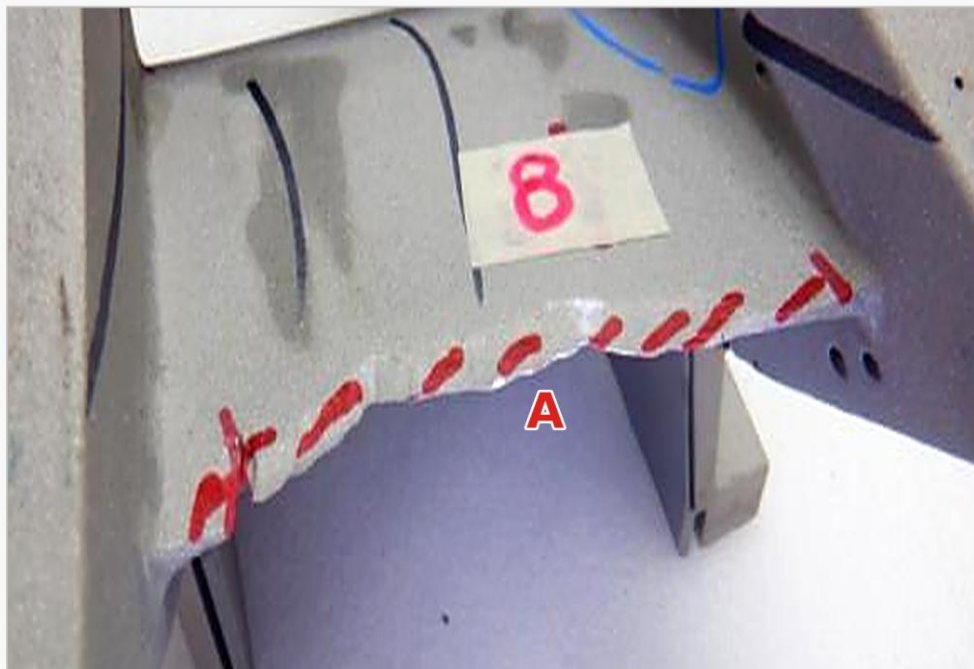
Through-wall loss at the nozzle trailing edge is structural damage in the hot-gas path, not a surface defect. Repair requires degraded-metal removal, weld build-up, EDM and/or PSP restoration, and dimensional requalification.

The two T1/T2 positions on Item 8 were unmeasurable; this condition approaches the repairability limit.

## FIG. 12 - TRAILING-EDGE CRACKING / THROUGH-WALL LOSS (ITEM 8)



**ORIGINAL INSPECTION PHOTOGRAPH**



**MAGNIFIED VIEW A**

**DOCUMENTED DAMAGE SIZE: 8 x 100 mm THROUGH-WALL LOSS (ITEM 8)**

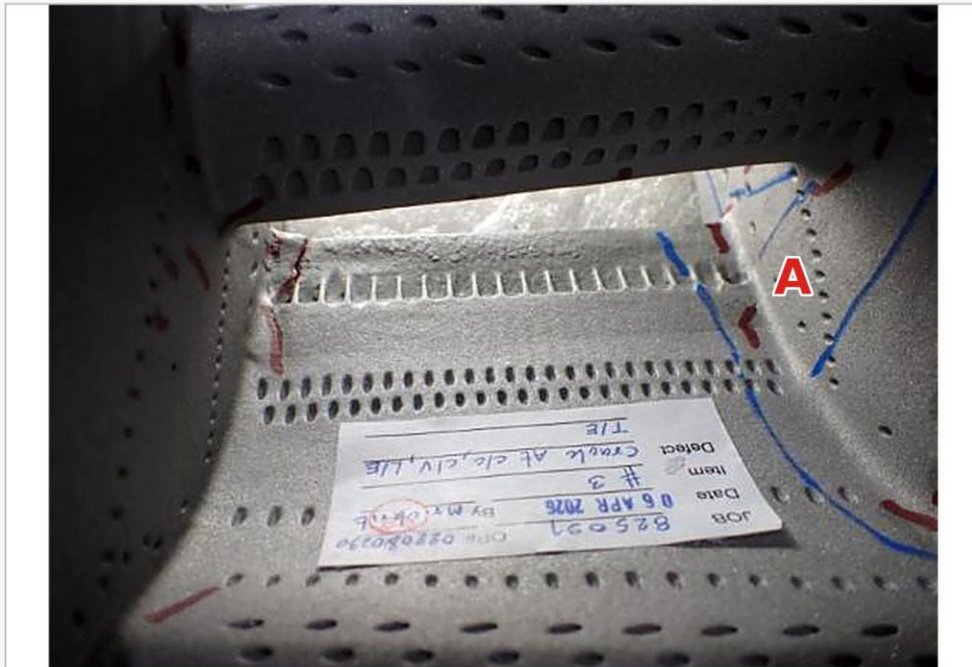
### **HEAVY REPAIR BASIS**

This second view confirms the extent of material loss along the critical trailing-edge wall.

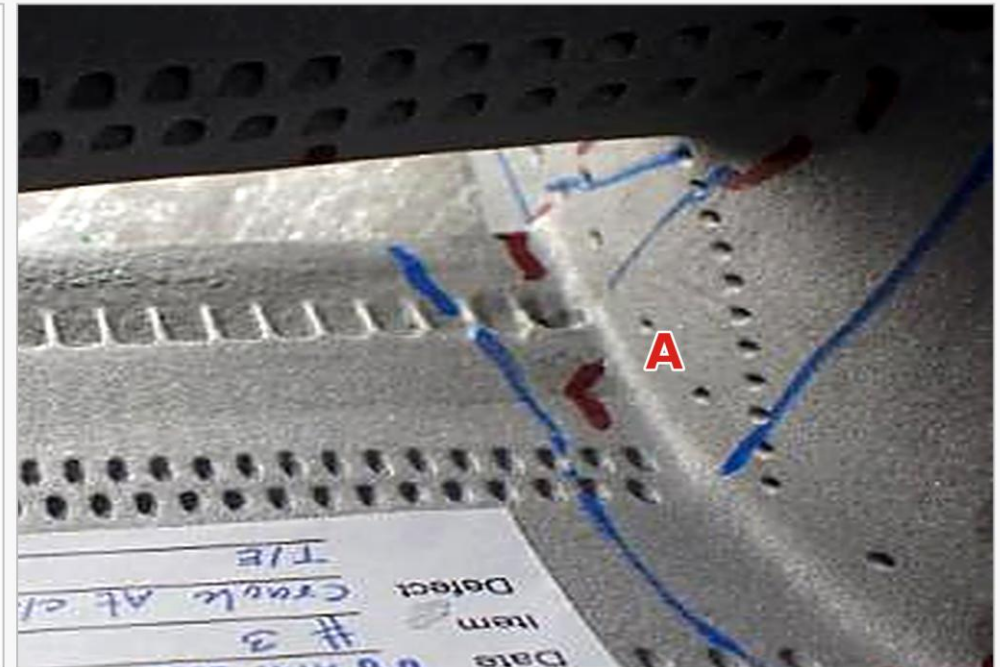
Local blending cannot replace missing wall structure or recover the required aerodynamic edge geometry.

Heavy Repair requires weld reconstruction and PSP/EDM restoration followed by full inspection and requalification.

## FIG. 13 - EXTENSIVE TRAILING-EDGE CRACKING AND HOT CORROSION



ORIGINAL INSPECTION PHOTOGRAPH



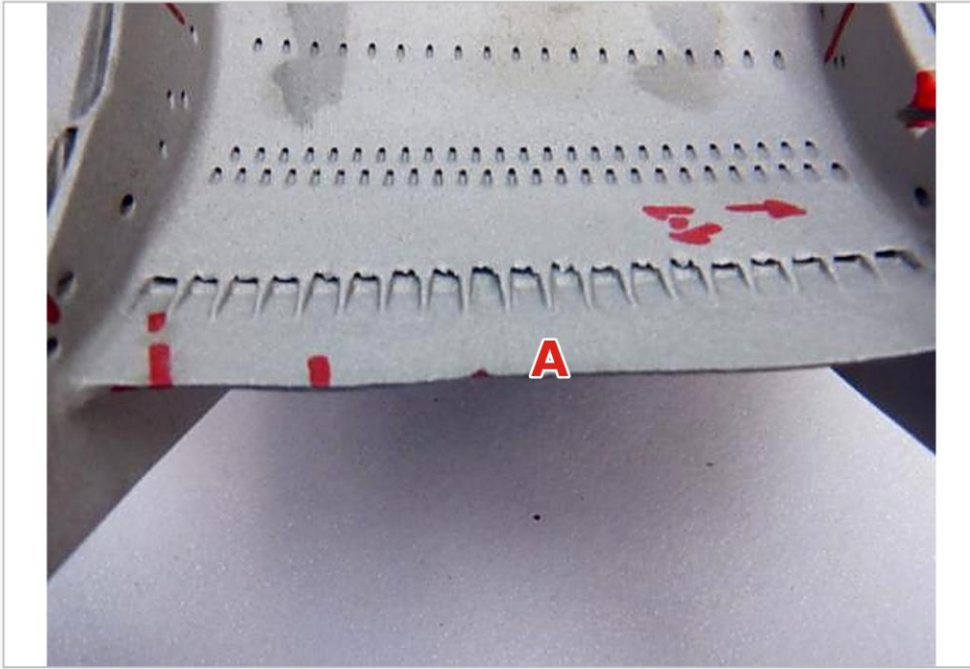
MAGNIFIED VIEW A

**DOCUMENTED TRAILING-EDGE CRACK RANGE (ALL 24): O/D 5-75 mm | I/D 5-25 mm**

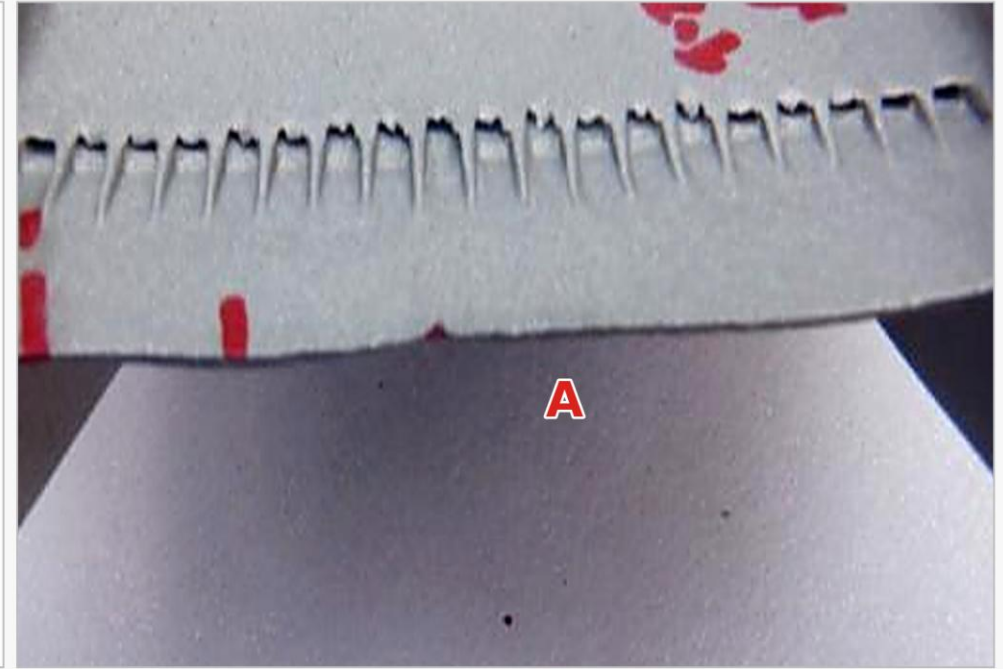
### HEAVY REPAIR BASIS

Cracking is located on high-temperature trailing-edge walls and is present on all 24 nozzle segments. The full-set crack distribution requires GTAW structural repair, TPR, and subsequent vacuum solution heat treatment. Heavy Repair is controlled by the critical location, pervasive extent, and restoration scope - not one crack length alone.

## FIG. 14 - HEAVY CORROSION - CONCAVE AIRFOIL AND TRAILING EDGE



**ORIGINAL INSPECTION PHOTOGRAPH**



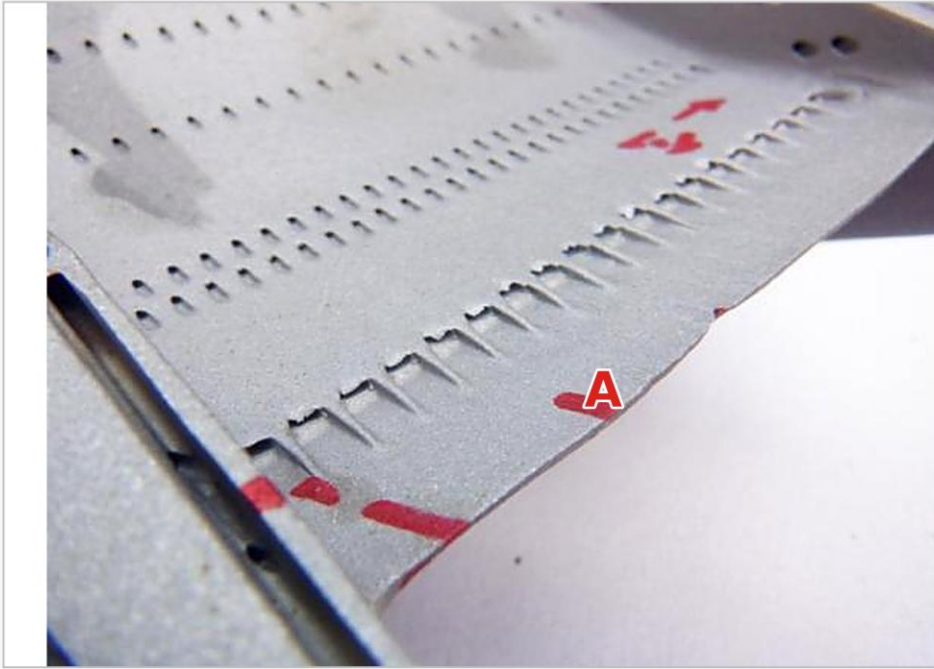
**MAGNIFIED VIEW A**

**SET-WIDE WALL DATA: 2.03 mm MIN. | LOWEST 1.12 mm | MEAN 1.57 mm**

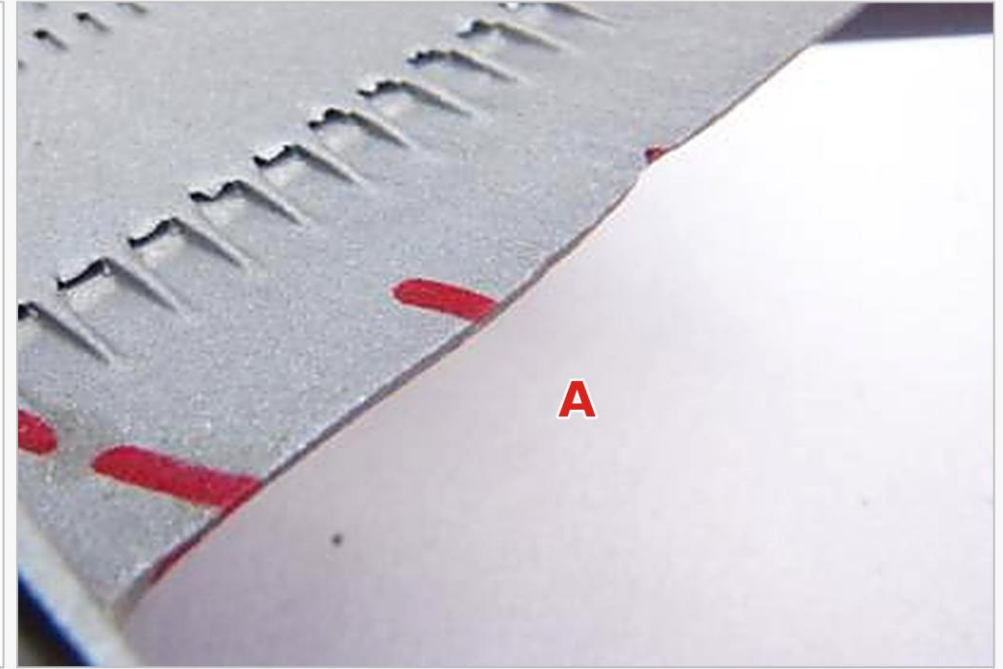
### **HEAVY REPAIR BASIS**

Hot corrosion at the concave airfoil and trailing edge causes structural metal loss in the gas-path region. All 48 airfoil trailing edges were rejected; 89 of 94 measurable T1/T2 readings were below the minimum. PSP wall restoration, corrosion removal, dimensional requalification, and full coating renewal are required.

## FIG. 15 - HEAVY CORROSION - CONCAVE AIRFOIL AND TRAILING EDGE



**ORIGINAL INSPECTION PHOTOGRAPH**



**MAGNIFIED VIEW A**

**SET-WIDE WALL DATA: 2.03 mm MIN. | LOWEST 1.12 mm | MEAN 1.57 mm**

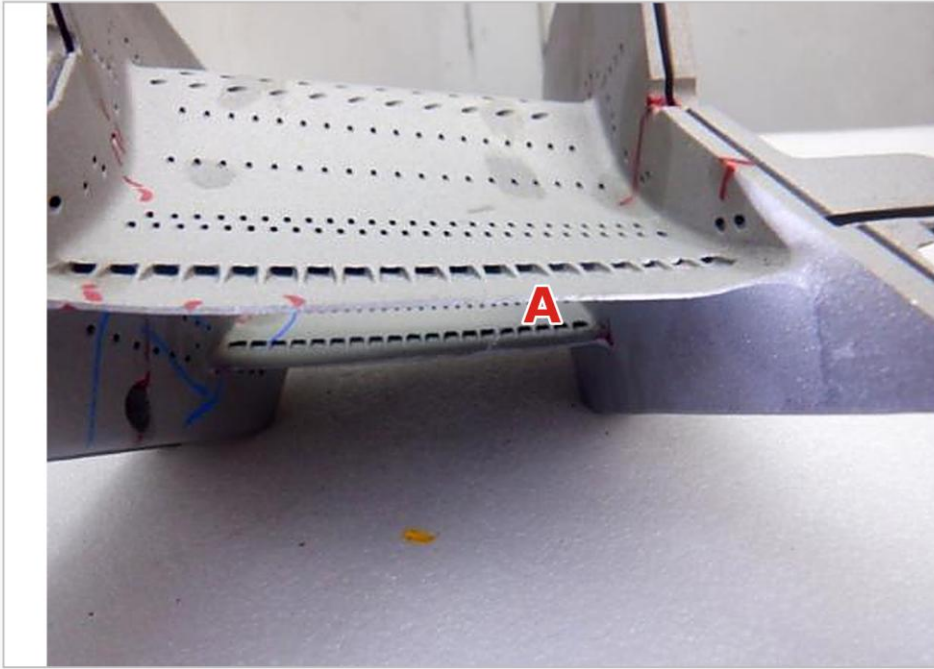
### **HEAVY REPAIR BASIS**

The visible surface attack is at the thin trailing-edge structure, where even localized loss affects strength and flow geometry.

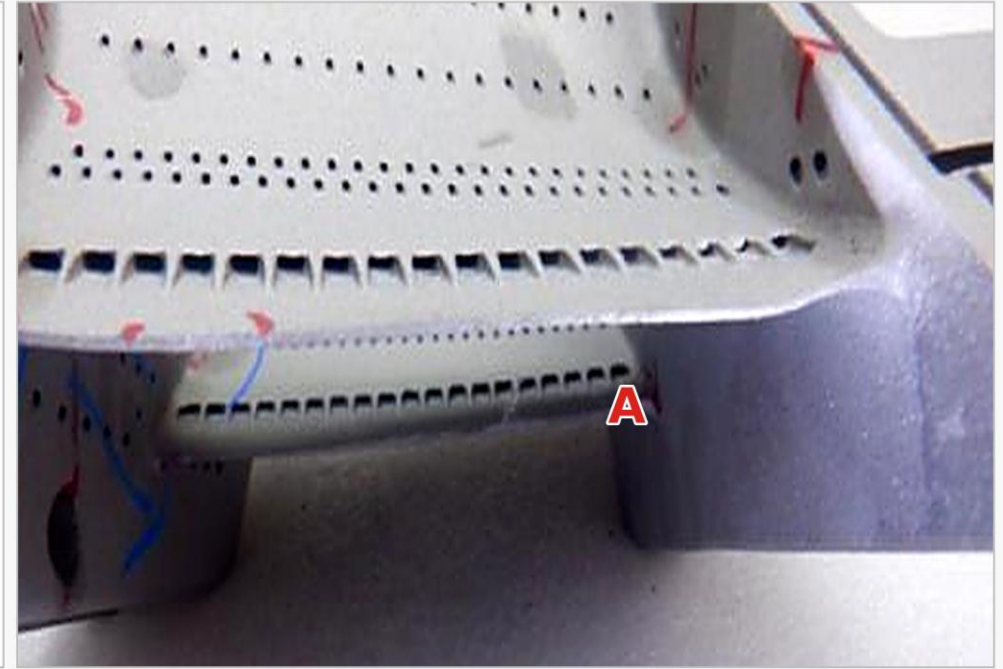
Measured wall rejection applies to every airfoil trailing edge in the set, requiring 48 PSP restoration positions.

The classification is based on measured metal loss and restoration extent, not coating deterioration by itself.

## FIG. 16 - CRITICAL TRAILING-EDGE BOWING AND THIN WALL



**ORIGINAL INSPECTION PHOTOGRAPH**



**MAGNIFIED VIEW A**

**SET-WIDE: 48/48 TRAILING EDGES REJECTED | 1.12 mm vs 2.03 mm MINIMUM**

### **HEAVY REPAIR BASIS**

Visible bowing is permanent flow-path deformation combined with critical trailing-edge wall thinning. Blending cannot restore alignment or thickness; cold straightening/plannishing plus PSP restoration is required. Recorded step deviation reaches -1.21 mm, requiring complete post-repair dimensional requalification.

## FIG. 17 - OUTER SHROUD WALL CORROSION / MATERIAL LOSS



ORIGINAL INSPECTION PHOTOGRAPH



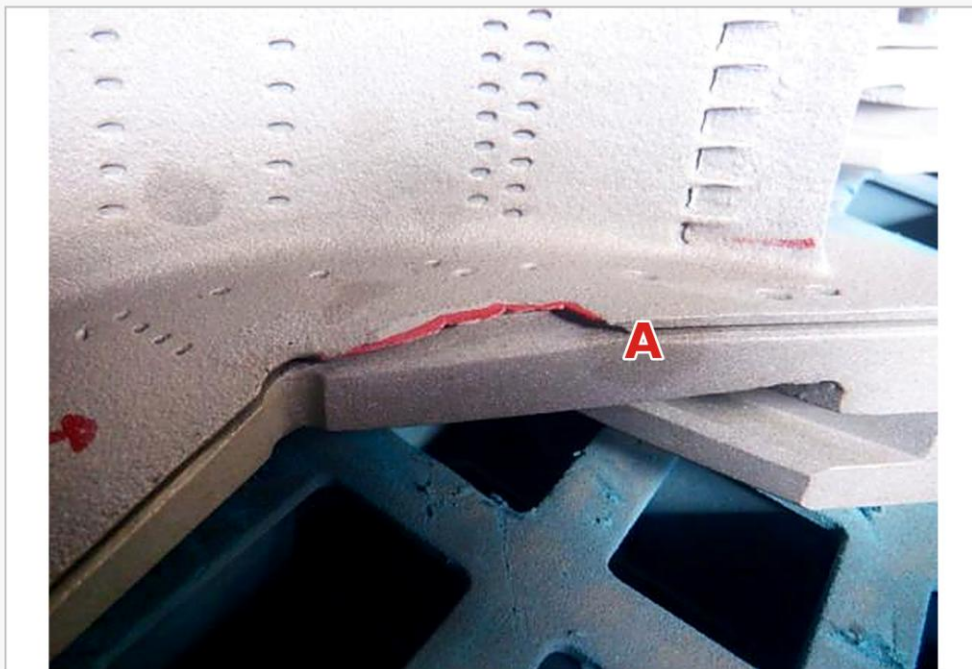
MAGNIFIED VIEW A

**DOCUMENTED O/D WALL RANGE: 5 x 30 TO 8 x 50 mm LOSS | 8-15 mm CRACKS**

### HEAVY REPAIR BASIS

Outer-shroud damage affects load-bearing and sealing surfaces; severity therefore depends strongly on location. Nine segments have missing-material patches requiring GTAW build-up; O/D wall cracks require TPR/GTAW where present. Heavy Repair is based on structural restoration of the shroud wall and full-set corrosion, not surface coating renewal alone.

## FIG. 18 - OUTER SHROUD WALL CORROSION / MATERIAL LOSS



**ORIGINAL INSPECTION PHOTOGRAPH**



**MAGNIFIED VIEW A**

**DOCUMENTED O/D WALL RANGE: 5 x 30 TO 8 x 50 mm LOSS | 8-15 mm CRACKS**

### **HEAVY REPAIR BASIS**

The magnified view shows damage at the shroud-wall junction, a structural and sealing interface. Even a locally short crack is Heavy Repair when excavation and weld reconstruction are required at this critical location. The complete repair includes corrosion removal, GTAW/TPR restoration as applicable, dimensional checks, and full recoat.

## 1. EXECUTIVE SUMMARY

Twenty-four (24) MS6001FA 1st stage nozzle segments were received and inspected. The inspection confirmed extreme and widespread damage affecting both airfoil sections and structural components on all 24 segments. Multiple heavy damage mechanisms are acting at the same time. These include extensive cracking, heavy hot corrosion, critical wall thinning, permanent deformation, and widespread coating deterioration requiring full strip and recoat.

Extensive cracking is confirmed 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. One segment exhibits through-wall material loss at the trailing edge. Widespread corrosion on concave airfoil surfaces and outer shroud walls further confirms material degradation under high temperature service conditions.

Ultrasonic wall thickness measurement at trailing edge positions T1 and T2 returned 89 of 94 measurable readings below the 2.03 mm minimum limit; the remaining 2 of the 96 defined positions could not be measured because of through-wall material loss (Item 8). All 48 airfoil trailing edges (2 airfoils per segment across 24 segments) were recorded as REJECT and require restoration. The lowest recorded reading is 1.12 mm, which is 0.91 mm (44.8%) below the minimum limit, and the mean of all readings is 1.57 mm, 22.6% below the limit. Additional geometric deviations, including bowing and misalignment, are confirmed and will affect flow path stability, sealing effectiveness, and overall turbine performance if not corrected.

The combined presence of structural cracking, through-wall material loss, geometric distortion, and universal dimensional non-conformance places this set beyond standard or medium repair. This condition cannot be corrected by routine blending, inspection, coating, or standard refurbishment alone; local or partial repair cannot recover the required geometry, thickness, or structural integrity. The nozzle set is classified as **HEAVY REPAIR, Severity Level 9 of 10 (Very Heavy, upper boundary)** under the UNEW Repair Severity Classification. The classification basis is summarized in Section 1.1 and derived in full in Section 4.

Full removal of degraded material, structural weld reconstruction, Transient Phase Restoration, trailing edge wall thickness restoration by PSP application on all 48 airfoil trailing-edge positions, dimensional requalification, and repeated controlled heat treatment are required to restore the components to a stable operating condition. No components are recommended for scrap; the set remains repairable through the Heavy Repair work scope defined in this report. This 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.

## 1.1 HEAVY REPAIR TECHNICAL BASIS

The Heavy Repair classification of this set rests on the measured findings summarized below. Each driver is independently documented in the referenced sections of this report; together they define a full-set restoration scope.

| Heavy Repair Driver                    | Evidence (This Set)                                                                                                                                                 | Repair Impact                                      |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| <b>100% trailing edge rejection</b>    | 48 of 48 airfoil trailing edges rejected across all 24 segments (Section 12.8).                                                                                     | PSP restoration on all 48 trailing-edge positions  |
| <b>Wall thickness below minimum</b>    | 89 of 94 measurable T1/T2 readings below the 2.03 mm minimum; lowest reading 1.12 mm (44.8% below limit); mean 1.57 mm (22.6% below limit) (Sections 3.4 and 12.8). | Structural trailing edge restoration               |
| <b>Through-wall / missing material</b> | Item 8: 8x100 mm through-wall loss at the trailing edge; O/D wall missing material patches on 9 of 24 segments (Section 3.6).                                       | Weld build-up, EDM, and PSP restoration            |
| <b>Full-set structural cracking</b>    | TPR and weld repair required on Items 1 to 24; multi-site crack networks on airfoils, walls, and shrouds (Sections 3.2 and 5.1).                                    | Full-set restoration; local repair not applicable  |
| <b>Metallurgical degradation</b>       | Grain boundary carbide coarsening and detrimental phase precipitation confirmed by material evaluation (Reports UNEW-ME-825091-01/-02/-03, Section 9).              | Mandatory vacuum solution heat treatment           |
| <b>Coating / substrate degradation</b> | Coating and substrate interface breakdown confirmed by material evaluation (Section 9).                                                                             | Full chemical strip and full recoat (MCrAlY + TBC) |
| <b>Dimensional distortion</b>          | Trailing edge bowing and permanent deformation; step deviations to -1.21 mm; gap and drop deviations recorded (Sections 3.5 and 12).                                | Cold straightening and dimensional requalification |

## BASIS OF CLASSIFICATION

This set is not classified as Heavy Repair because standard processes such as cleaning, FPI, coating, heat treatment, or dimensional inspection appear in the work scope; those processes are common to all repair levels. It is classified as Heavy Repair because the incoming condition shows full-set structural damage, universal trailing edge wall thickness rejection, through-wall material loss, metallurgical degradation, and a full trailing edge restoration requirement. These findings require structural restoration beyond routine refurbishment.

The scope of work (Section 8) identifies the repair processes applied to this component. The repair classification is determined by the actual incoming damage condition and the extent of restoration required, as documented in Sections 3, 4, 9, and 12 of this report.

## APPLICABILITY OF LOWER REPAIR LEVELS

| Lower Repair Level Argument | Why Not Applicable |
|-----------------------------|--------------------|
|-----------------------------|--------------------|

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|                                                                   |                                                                                                                                                                                                  |
|-------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Standard FPI, inspection, and coating processes appear in the SOW | The classification is based on the measured damage condition, not on the names of the processes applied (Section 8 note).                                                                        |
| Local blending can restore the surfaces                           | Blending cannot restore 48 rejected trailing edge wall thickness positions; PSP structural restoration is required (Section 12.8).                                                               |
| Standard weld repair is sufficient                                | All 24 segments require full structural crack repair with TPR and subsequent vacuum solution heat treatment, in addition to PSP restoration (Sections 3.2 and 5).                                |
| Coating renewal is routine refurbishment                          | Coating is one element only; the classification is driven by structural wall loss, through-wall material loss, full-set cracking, distortion, and metallurgical degradation (Section 1.1 table). |
| Some dimensional results are within limits                        | Classification is governed by the more severe conditions: universal trailing edge rejection and through-wall material loss (Section 4).                                                          |

## 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                                                                     |                                                                         |
|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| Date of report                                                                        | 27 April 2026                                                           |
| Customer P.O. no.                                                                     | 1003986864                                                              |
| UNEW Job Order no.                                                                    | 825091                                                                  |
| Component Details                                                                     |                                                                         |
| Engine type                                                                           | MS6001FA                                                                |
| Component type                                                                        | 1st Stage Nozzle                                                        |
| Component part number                                                                 | Retaining ring P/N: 143E5711G02  <br>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) | -                                                                       |

### 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. Together with 476 initiated starts and 180 fired starts, the unit counters record a severe cyclic thermal loading history with repeated thermal shock events that accelerate cracking and hot corrosion.
- Breaker Trips at Load: 127, consistent with heavy cyclic thermal loading causing fatigue crack propagation at trailing edges and platform junctions.
- As-received coating: HVOF MCrAlY with full TBC top coat. Widespread coating deterioration with confirmed coating/substrate interface degradation (Section 9); full strip and recoat required.

The following damage categories were identified across all 24 nozzle segments:

| Damage Category                                             | Finding (As Inspected)                                                                                                                                                                                                      | Disposition                        |
|-------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| <b>Trailing Edge Cracking</b>                               | Extensive cracks 5 to 75 mm at O/D wall and 5 to 25 mm at I/D wall, on all 24 segments (Items 1 to 24).                                                                                                                     | <b>TPR + Weld</b>                  |
| <b>Multi-Cracking at Airfoil Body</b>                       | Multi-crack networks 15x40 mm <sup>2</sup> to 30x120 mm <sup>2</sup> on concave and convex surfaces, leading edge and trailing edge, on all 24 segments.                                                                    | <b>TPR Required</b>                |
| <b>Non-Gas Path Cracking (I/D and O/D Wall)</b>             | Cracks 8 to 20 mm at I/D wall (non-gas path) on all segments. Cracks 8 to 15 mm at O/D wall on Items 1, 3, 22, 23.                                                                                                          | <b>TPR / Weld</b>                  |
| <b>Heavy Corrosion at Trailing Edge and Concave Airfoil</b> | Heavy oxidation and hot corrosion on trailing edge and concave airfoil faces across all 24 segments. Heavy corrosion on outer shroud wall.                                                                                  | <b>Blend + Braze</b>               |
| <b>Trailing Edge Wall Thickness Below Minimum</b>           | 48 of 48 airfoil trailing edges non-conforming: 89 of 94 measurable T1/T2 positions below the 2.03 mm minimum and 2 positions unmeasurable. One segment (Item 8) shows through-wall material loss at the trailing edge.     | <b>PSP Required (48 positions)</b> |
| <b>Trailing Edge Bowing / Distortion</b>                    | Visible bowing and thin wall permanent deformation on trailing edges requiring cold straightening and planishing.                                                                                                           | <b>Straighten / PSP</b>            |
| <b>Missing Material at O/D Wall and T/E</b>                 | Missing material patches 5x30 mm to 8x50 mm at O/D wall on Items 1, 2, 4, 5, 6, 11, 14, 15, 17. Missing material 8x100 mm at trailing edge on Item 8.                                                                       | <b>Weld Build-up</b>               |
| <b>Coating Deterioration (TBC + MCrAlY)</b>                 | Widespread coating deterioration with confirmed coating/substrate interface degradation (Section 9). TBC requires full strip and recoat; HVOF MCrAlY bond coat depleted. Full gas path recoat required on the complete set. | <b>Full Strip + Recoat</b>         |

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|                                              |                                                                                                                                                                                                                                |                         |
|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| <b>Base Metal Microstructure Degradation</b> | As-received FSX-414 shows grain boundary carbide coarsening and detrimental phase precipitation. After pre-weld solution heat treatment, hardness measured 27.1 to 30.9 HRC; material recoverable for weld repair (Section 9). | <b>Recovered via HT</b> |
|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|

### 3.1 DIMENSIONAL INSPECTION SUMMARY

Key dimensional findings from the incoming inspection are summarized below:

| Inspection Parameter                            | Result                                                                                                                                                                                                                             | Status                     |
|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| <b>Trailing Edge Wall Thickness (T1 and T2)</b> | 48 of 48 airfoil trailing edges non-conforming. 89 of 94 measurable positions below the 2.03 mm minimum; 2 positions unmeasurable (through-wall loss, Item 8). PSP restoration required on all 48 airfoil trailing-edge positions. | <b>REJECT: 24/24</b>       |
| <b>Nozzle Alignment (Step Between Segments)</b> | Step deviations recorded on multiple segments against nominal datum. Largest recorded step deviations: -1.21 mm (Seg 11), -1.16 mm (Seg 16), -0.94 mm (Seg 4). Straightening and dimensional requalification required.             | <b>DEVIATIONS RECORDED</b> |
| <b>Nozzle Set Roundness</b>                     | 0.80 mm (A-A: 1732.70 / B-B: 1733.42 / C-C: 1733.50 / D-D: 1732.95 mm). Recorded as incoming baseline.                                                                                                                             | <b>RECORDED</b>            |
| <b>Total Nozzle Flow Area</b>                   | 132,124.07 mm <sup>2</sup> (204.793 in <sup>2</sup> ). Area deviation 0.33%.                                                                                                                                                       | <b>WITHIN LIMIT</b>        |
| <b>Retaining Ring Roundness, Upstream</b>       | Max-Min: 1.21 mm (range 1715.11 to 1716.32 mm). Recorded as incoming baseline.                                                                                                                                                     | <b>RECORDED</b>            |
| <b>Retaining Ring Roundness, Downstream</b>     | Max-Min: 0.92 mm (range 1687.46 to 1688.38 mm). Recorded as incoming baseline.                                                                                                                                                     | <b>RECORDED</b>            |
| <b>Harmonic Analysis, Throat Areas</b>          | Individual segment area deviations within the acceptable range (max deviation under plus or minus 10% on individual throats).                                                                                                      | <b>ACCEPTABLE</b>          |

*Note: Wall thickness and throat area are assessed against the stated acceptance limits (2.03 mm minimum; plus or minus 10% area deviation). Alignment, gap, drop check, and roundness measurements are recorded against nominal datum as the incoming baseline; final acceptance of these dimensions is verified at post-repair dimensional requalification (Section 8).*

### 3.2 PERVASIVE MULTI-SITE CRACKING (100% OF SEGMENTS AFFECTED)

The defect records and FPI results confirm that all 24 nozzle segments exhibit cracking at multiple locations. This is a primary driver for the Heavy Repair classification:

- Trailing edge (T/E): Extensive cracks ranging 5 to 75 mm at the O/D wall and 5 to 25 mm at the I/D wall across all segments (Items 1 to 24). Photographs (Figs. 11 to 13) show severe crack networks with associated heavy corrosion at the trailing edge.

- Airfoil body multi-cracking: Crack networks 15x40 mm<sup>2</sup> to 30x120 mm<sup>2</sup> covering the concave, convex, leading edge, and trailing edge surfaces on all 24 segments. Transient Phase Restoration (TPR) is required.
- Non-gas-path I/D and O/D walls: Cracks 8 to 20 mm (non-gas path) on all segments. Cracks 8 to 15 mm on the O/D wall at Items 1, 3, 22, and 23.
- Individual segment anomalies: Item 19 exhibits a 50 mm crack at the concave face, a non-typical defect warranting specific weld repair attention.

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

### 3.3 HEAVY HOT CORROSION AND OXIDATION

Photographs (Figs. 14 to 18) and defect records confirm:

- Heavy corrosion on the concave airfoil face and trailing edge, resulting in critical metal loss and surface pitting (Items 1 to 24).
- Heavy oxidation on the outer shroud (O/D) wall. This is 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 in morphology with Type I or Type II high temperature hot corrosion under severe service exposure. Fuel chemistry and operating history should be reviewed separately if root cause confirmation is required. The resulting material loss is addressed through the Heavy Repair work scope.

### 3.4 TRAILING EDGE WALL THICKNESS, ALL 24 SEGMENTS REJECTED

Post-strip ultrasonic wall thickness inspection at positions T1 and T2 (trailing edge locations) confirmed universal non-conformance against the minimum allowable wall thickness of 2.03 mm. The measured data set (Section 12.8) is summarized below:

| Trailing Edge Wall Thickness — Statistical Summary                                | Result (T1 / T2 positions)                   |
|-----------------------------------------------------------------------------------|----------------------------------------------|
| Positions defined (24 segments × 2 airfoils × T1, T2)                             | 96                                           |
| Positions unmeasurable due to through-wall material loss (Item 8, S/N A1FC 04955) | <b>2</b>                                     |
| Measured readings below the 2.03 mm minimum                                       | <b>89 of 94 (94.7%)</b>                      |
| Lowest recorded reading (Item 21, Airfoil #2, T2)                                 | <b>1.12 mm — 0.91 mm (44.8%) below limit</b> |
| Mean of all 94 measured readings                                                  | <b>1.57 mm — 22.6% below limit</b>           |
| Readings at or below 1.50 mm / at or below 1.30 mm                                | 38 / 18                                      |

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|                                                                                                                                                       |          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| Readings at or above the minimum (maximum 2.26 mm, within 0.23 mm of the limit; in every case the paired position on the same airfoil is below limit) | 5        |
| Airfoil trailing edges REJECT                                                                                                                         | 48 of 48 |
| Segments REJECT                                                                                                                                       | 24 of 24 |

- Trailing edge wall thinning is consistent with combined high temperature oxidation, hot corrosion, and service related deformation. The classification is based on the measured wall thickness rejection and the restoration scope required.
- Item 8 (S/N A1FC 04955) additionally shows missing material at the trailing edge (8x100 mm), confirming through-wall material loss. Through-wall loss is the condition that defines the approach to the repairability limit.
- Corrective action: Application of Pressure Side Plate (PSP) for trailing edge wall thickness restoration is required on all 48 airfoil trailing-edge positions (2 airfoils per segment x 24 segments = 48 positions). PSP restoration is applied per airfoil trailing edge; every one of the 48 positions carries at least one reading below the minimum limit, so the 48-position scope follows directly from the measured data in Section 12.8. This is classified as an Additional (non-standard) work item.

### 3.5 TRAILING EDGE BOWING AND AIRFOIL DISTORTION

Visible bowing and permanent deformation of the trailing edge walls were documented in Fig. 16, with accompanying annotation confirming the thin wall condition requiring PSP. Cold straightening and planishing 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 5x30 mm to 8x50 mm identified on Items 1, 2, 4, 5, 6, 11, 14, 15, and 17 (9 of 24 segments).
- Trailing Edge, Item 8: Missing material 8x100 mm at the trailing edge, the largest single missing material defect in the set. Weld build-up and EDM or PSP restoration is 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 THERMAL BARRIER COATING (TBC) AND MCRALY DETERIORATION

The as-received coating system (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 UNEW-ME-825091-01 (Section 9, Fig. 1) confirmed severe breakdown at the coating and substrate interface. Full reapplication of HVOF MCrAlY and TBC top coat is required on the complete set.

### 3.8 BASE METAL CONDITION, FSX-414 (RECOVERABLE)

Metallurgical analysis (Reports UNEW-ME-825091-01, Item 13 Inner Shroud; UNEW-ME-825091-02, Item 11; UNEW-ME-825091-03, 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 satisfactorily refined. Hardness results: 30.9 HRC (inner shroud) and 27.1 HRC (trailing edge), within UNEW's approved acceptance range for FSX-414 weld repair eligibility.
- Recommendation: Base material is suitable for repair. All components will undergo full vacuum solution heat treatment as part of the Heavy Repair process.

### 3.9 SPARE PART (REPAIR / REPLACE)

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

*Note: Replacement of consumable and removable hardware listed above is not the basis of the Heavy Repair classification. The classification is based on structural cracking, through-wall and missing material, universal trailing edge wall thickness rejection, airfoil distortion, metallurgical degradation, and the full-set restoration requirement (Sections 1.1, 3, 4, and 12).*

#### 4. REPAIR SEVERITY CLASSIFICATION

UNEW applies a 10 level Repair Severity Classification to all gas turbine capital parts refurbishment. Levels 1 to 3 represent Light Repair. Levels 4 to 7 represent Standard or Medium Refurbishment. Levels 8 to 10 represent Heavy Repair. Repair severity is determined by the actual incoming condition of the component and the restoration effort required to return the part to serviceable condition.

Based on the incoming inspection findings, this set of 24 first stage nozzle segments is classified as **HEAVY REPAIR, Severity Level 9 of 10 (Very Heavy, upper boundary)**. This designation is derived from the recorded inspection data summarized in this section.

The repair level is determined by the combination of damage location, measured non-conformance, crack extent, wall thickness loss, missing material, metallurgical condition, and the total restoration scope required. The classification is set by the recorded inspection data in Sections 12 and 13, evaluated against fixed acceptance limits, and reflects the full restoration scope required across the complete set. The five core technical review categories of the UNEW classification basis are assessed below:

| Review Category                         | Confirmed Condition (This Set)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Severity Contribution  |
|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| <b>Welding and Material Buildup</b>     | Trailing edge cracks up to 75 mm and airfoil multi-crack networks up to 30x120 mm <sup>2</sup> on 24 of 24 segments. Missing material at nine O/D walls and through-wall loss of 8x100 mm at one trailing edge. Full crack excavation, GTAW weld reconstruction, weld build-up, and Transient Phase Restoration are required. This is major structural restoration across every unit.                                                                                                                                                                                                              | <b>Heavy (Level 9)</b> |
| <b>Dimensional Restoration</b>          | Trailing edge wall thickness: REJECT on 24 of 24 segments; 48 of 48 airfoil trailing edges non-conforming, with 89 of 94 measurable T1/T2 positions below the 2.03 mm minimum and 2 positions unmeasurable due to through-wall loss. Trailing edge bowing and permanent deformation across the full set requiring cold straightening. Step and alignment deviations recorded on multiple segments requiring straightening and requalification. Wall thickness results are objective pass or fail against the 2.03 mm limit. PSP restoration is required on all 48 airfoil trailing-edge positions. | <b>Heavy (Level 9)</b> |
| <b>Coating and Base Metal Condition</b> | Metallurgical examination confirmed severe breakdown at the coating and substrate interface with the MCrAlY bond coat depleted. The as-received base metal showed heavy grain boundary carbide coarsening and detrimental phase precipitation so severe that mandatory vacuum solution heat treatment was required before any repair work could begin. Full coating system removal and reapplication is required.                                                                                                                                                                                  | <b>Heavy (Level 9)</b> |

## INCOMING INSPECTION REPORT



|                                                         |                                                                                                                                                                                                                                                                                                                                                                                 |                        |
|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| <b>Cooling Hole and Cooling Passage Recovery</b>        | Cooling hole flow recovery is in the repair route, with EDM restoration of cooling holes and seal slots and cooling hole flow checks before coating. All 144 leading and trailing edge core plugs (96 leading edge, 48 trailing edge) and all 48 impingement cover plates require replacement, as listed in Section 3.9, to restore the cooling system.                         | <b>Heavy (Level 9)</b> |
| <b>Inspection, Heat Treatment, and Engineering Risk</b> | The repair route requires two full vacuum solution heat treatments as a minimum, HF and vacuum cleaning for TPR, repeated FPI cycles, ultrasonic wall thickness verification, and full harmonic and roundness requalification at final assembly. The operating history of 125 emergency trips and 127 breaker trips at load adds engineering risk to every acceptance decision. | <b>Heavy (Level 9)</b> |

Level 9 (Very Heavy, the upper boundary of the Heavy Repair band) in the UNEW classification is defined as extensive full-set or critical-zone restoration: widespread damage across many parts, major geometry restoration, multiple heat cycles, repeated FPI and NDT, and high repair labor and acceptance risk. Every element of that definition is present in this set, and it is present on all 24 segments at the same time. Several categories sit at the top of Level 9, most notably the universal trailing edge rejection and the through-wall material loss at Item 8. Where multiple criteria apply, the more severe technical condition governs the classification.

Level 10 is reserved for components at or near the technical repair limit, where non-repairable disposition is possible. All 24 segments remain repairable, but the margin between their as-received condition and that retirement limit is small. The set is therefore designated Severity Level 9 of 10 (Very Heavy, upper boundary), the most severe classification available for a repairable set. The documented condition requires Heavy Repair classification under the criteria assessed above.

## 5. 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 sectioning, UNEW Engineering has evaluated all 24 segments of the MS6001FA 1st Stage Nozzle set (UNEW Job 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 material loss, extensive hot corrosion, universal trailing edge wall thinning below minimum limits, and missing material, confirms that this set requires HEAVY REPAIR at the most severe repairable level. No segment in the set is eligible for a lower repair classification: every segment carries rejected trailing edge wall thickness and requires TPR, weld, and blend restoration, with PSP restoration additionally required on all 48 airfoil trailing-edge positions.

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

- 476 Total Initiated Starts, 180 Fired Starts, and 125 Emergency Trips recorded on the unit counters: a severe cyclic thermal loading history driving fatigue cracking at trailing edges and airfoil bodies.
- 127 Breaker Trips at Load: consistent with repeated thermal shock events accelerating hot corrosion and crack propagation.
- Complete service history was not available beyond the operating counter data listed in this report; fired hours, fuel type, prior repair count, and maintenance interval records were not supplied. A conservative repair approach has therefore been applied.

### 5.1 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.

| No. | Defect / Condition                                                | Location / Affected Items                                                               | Repair Method                            | Action          |
|-----|-------------------------------------------------------------------|-----------------------------------------------------------------------------------------|------------------------------------------|-----------------|
| 1   | <b>Extensive cracking at Trailing Edge (T/E)</b>                  | O/D Wall: cracks 5 to 75 mm, Items 1 to 24. I/D Wall: cracks 5 to 25 mm, Items 1 to 24. | <b>GTAW Weld + Blend</b>                 | <b>REQUIRED</b> |
| 2   | <b>Multi-cracking at Airfoil Body (concave, convex, L/E, T/E)</b> | Crack networks 15x40 mm <sup>2</sup> to 30x120 mm <sup>2</sup> , all 24 segments.       | <b>Transient Phase Restoration (TPR)</b> | <b>REQUIRED</b> |
| 3   | <b>Non-gas path cracking at I/D and O/D Wall</b>                  | I/D Wall: 8 to 20 mm, Items 1 to 24. O/D Wall: 8 to 15 mm, Items 1, 3, 22, 23.          | <b>TPR / GTAW Weld</b>                   | <b>REQUIRED</b> |
| 4   | <b>Single large crack at concave airfoil</b>                      | 50 mm crack, Item 19 only (non-typical).                                                | <b>GTAW Weld + Blend</b>                 | <b>REQUIRED</b> |

## INCOMING INSPECTION REPORT



|    |                                                                        |                                                                                                           |                            |                 |
|----|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|----------------------------|-----------------|
| 5  | <b>Heavy hot corrosion at T/E and concave airfoil face</b>             | Gas path surfaces, all 24 segments (Figs. 11 to 15).                                                      | Blend to Remove            | REQUIRED        |
| 6  | <b>Heavy corrosion at Outer Shroud (O/D) Wall</b>                      | O/D Wall surface, all 24 segments (Figs. 17 and 18).                                                      | Blend to Remove            | REQUIRED        |
| 7  | <b>Light to medium corrosion at I/D Wall and non-gas path surfaces</b> | I/D Wall and non-gas path, all 24 segments.                                                               | Blend to Remove            | REQUIRED        |
| 8  | <b>Trailing Edge wall thickness below minimum limit (T1 and T2)</b>    | ALL 24 segments; 48 of 48 airfoil trailing edges. Item 8: through-wall missing material at T/E, 8x100 mm. | Apply PSP (48 positions)   | ADDITIONAL ITEM |
| 9  | <b>Trailing Edge bowing and permanent deformation</b>                  | All T/E faces, confirmed across the full set (Fig. 16).                                                   | Cold Straighten / Plannish | REQUIRED        |
| 10 | <b>Missing material at O/D Wall</b>                                    | Patches 5x30 mm to 8x50 mm, Items 1, 2, 4, 5, 6, 11, 14, 15, 17 (9 of 24 segments).                       | GTAW Weld Build-up         | REQUIRED        |
| 11 | <b>Full TBC and MCrAlY coating degradation</b>                         | All gas path surfaces, complete set.                                                                      | Full Strip + Recoat        | REQUIRED        |
| 12 | <b>Base metal microstructure degradation (grain boundary carbide)</b>  | FSX-414 substrate, confirmed via metallurgical analysis (UNEW-ME-825091-01).                              | 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.

## 5.2 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 |

## INCOMING INSPECTION REPORT



|    |                                                                                        |                      |
|----|----------------------------------------------------------------------------------------|----------------------|
| 4  | Post-HT FPI + visual inspection; record all defects per defect chart                   | All 24 Segments      |
| 5  | Cold straightening / planishing 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 the 2.03 mm minimum or greater | 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         |

### 5.3 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 |

## INCOMING INSPECTION REPORT



|                                                   |                       |                 |
|---------------------------------------------------|-----------------------|-----------------|
| 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 |

### 5.4 ENGINEERING RECOMMENDATION CONCLUSION

**CLASSIFICATION: HEAVY REPAIR, SEVERITY LEVEL 9 OF 10 (VERY HEAVY, UPPER BOUNDARY), All 24 Segments**

UNEW Engineering confirms that the complete set of 24 MS6001FA 1st Stage Nozzle segments (UNEW Job Order 825091) is classified as HEAVY REPAIR, Severity Level 9 of 10 (Very Heavy, upper boundary), 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, through-wall missing material, and widespread coating deterioration with confirmed coating/substrate interface 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 airfoil trailing-edge positions), is required and forms part of the Heavy Repair work scope of this work order; the 48-position quantity follows directly from the measured wall thickness data recorded in Section 12.8.

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

Based on the objective inspection results summarized in this report, a classification below Severity Level 9 would not reflect the measured incoming condition or the restoration scope required.

## 6. PACKING LIST FROM CUSTOMER

PACKING LIST FROM CUSTOMER

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

## 7. COMPONENT SERIAL NUMBER CORRELATION

### CORRELATION SHEET

|                            |                                     |
|----------------------------|-------------------------------------|
| Retaining ring part number | P/N: 143E5711G02<br>S/N: SNEG642589 |
|----------------------------|-------------------------------------|

| 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   |

## INCOMING INSPECTION REPORT



|    |               |            |        |
|----|---------------|------------|--------|
| 23 | 129E9734 P002 | A1FC 04996 | FSX414 |
| 24 | 129E9734 P002 | A1FC 04961 | FSX414 |

## 8. SCOPE OF WORK

### MS6001FA STAGE 1 NOZZLE

| Work Scope                                                                          | Inspect | Heavy Repair Scope |
|-------------------------------------------------------------------------------------|---------|--------------------|
| <b>Inspect</b>                                                                      |         |                    |
| 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       |                    |
| <b>Repair</b>                                                                       |         |                    |
| 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                  |

## INCOMING INSPECTION REPORT



|                                                                                                            |  |   |
|------------------------------------------------------------------------------------------------------------|--|---|
| 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 |
| <b>Coating</b>                                                                                             |  |   |
| 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, Qty 48 (airfoil trailing-edge positions; 2 airfoils per segment x 24 segments).

*Note: The processes listed above define the work scope applied to this component. The repair classification is determined by the incoming damage condition documented in this report, not by the process list (see Section 1.1).*

## 9. MATERIAL EVALUATION

|                           |                                     |                         |                                                                                           |
|---------------------------|-------------------------------------|-------------------------|-------------------------------------------------------------------------------------------|
| <b>Report No.</b>         | UNEW-ME-825091-01                   | <b>Job Order No.</b>    | 825091                                                                                    |
| <b>Serial No. (or ID)</b> | Item 13                             | <b>Cutting Location</b> | Inner Shroud                                                                              |
| <b>Received Status</b>    | As-Received                         | <b>Hardness Test</b>    | Not required at as-received stage; post-HT hardness reported in UNEW-ME-825091-02 and -03 |
| <b>Grain Size</b>         | Refer to micrographs, Figs. 1 and 2 | <b>Coating Type</b>     | TBC coating                                                                               |
| <b>Nearest Alloy</b>      | FSX-414                             |                         |                                                                                           |

| Element            | Co   | Cr   | Ni   | Ti | W   | Ta | Mo | Fe  |
|--------------------|------|------|------|----|-----|----|----|-----|
| <b>Nominal (%)</b> | 52.5 | 29.0 | 10.0 | -  | 7.5 | -  | -  | 1.0 |
| <b>Result (%)</b>  | 49.8 | 28.1 | 12.0 | -  | 7.1 | -  | -  | 2.0 |



Fig. 1: Heavy coating degradation exposing base metal

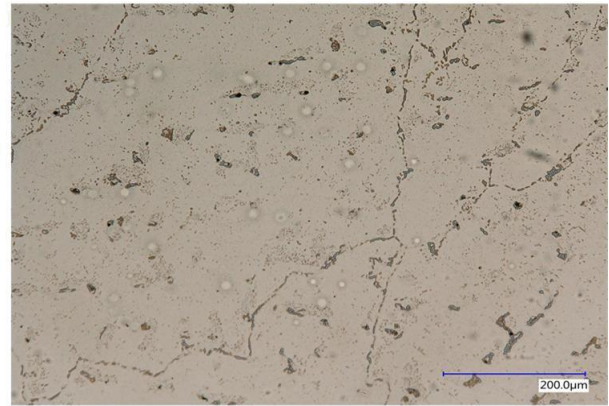


Fig. 2: Heavy grain boundary damage at high magnification (Etched)

Specimen UNEW-ME-825091-01 was prepared and examined to assess material condition for repair eligibility. Hot gas path coating (TBC) showed severe degradation with heavy breakdown at the coating and substrate interface, refer to Fig. 1. Base material was 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, refer to 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.

|                           |                                     |                         |                                 |
|---------------------------|-------------------------------------|-------------------------|---------------------------------|
| <b>Report No.</b>         | UNEW-ME-825091-02                   | <b>Job Order No.</b>    | 825091                          |
| <b>Serial No. (or ID)</b> | Item 11                             | <b>Cutting Location</b> | Inner Shroud                    |
| <b>Received Status</b>    | Pre-Weld HT                         | <b>Hardness Test</b>    | 30.9 HRC                        |
| <b>Grain Size</b>         | Refer to micrographs, Figs. 1 and 2 | <b>Coating Type</b>     | (Refer to as-received analysis) |
| <b>Nearest Alloy</b>      | FSX-414                             |                         |                                 |



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

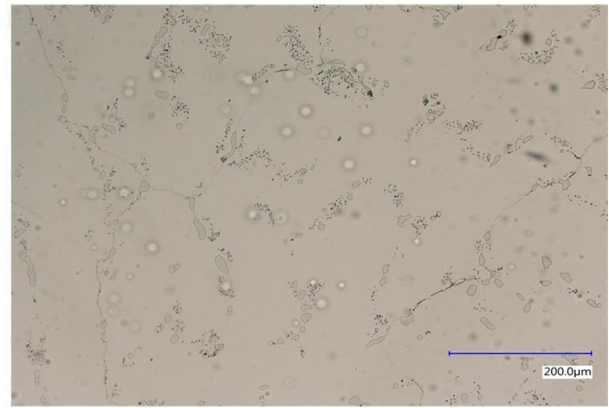


Fig. 2: Severe grain boundary attack and carbide deterioration at high magnification (Etched)

Specimen UNEW-ME-825091-02 was prepared and examined to evaluate base material microstructure in the 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 UNEW-ME-825091-01 have been successfully refined to an acceptable condition for Heavy Repair welding operations (Figs. 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. The 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.

|                           |                                     |                         |                                 |
|---------------------------|-------------------------------------|-------------------------|---------------------------------|
| <b>Report No.</b>         | UNEW-ME-825091-03                   | <b>Job Order No.</b>    | 825091                          |
| <b>Serial No. (or ID)</b> | Item 8                              | <b>Cutting Location</b> | Trailing Edge                   |
| <b>Received Status</b>    | Pre-Weld HT                         | <b>Hardness Test</b>    | 27.1 HRC                        |
| <b>Grain Size</b>         | Refer to micrographs, Figs. 1 and 2 | <b>Coating Type</b>     | (Refer to as-received analysis) |
| <b>Nearest Alloy</b>      | FSX-414                             |                         |                                 |

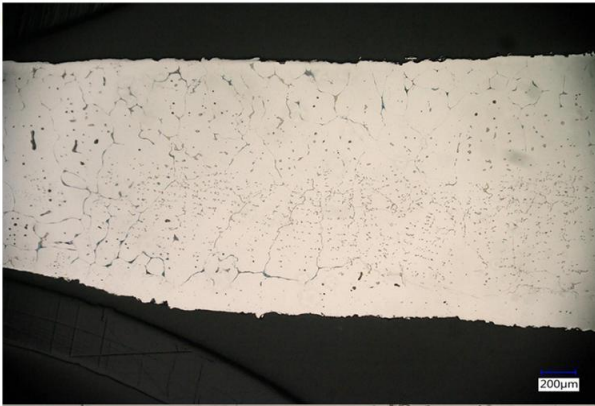


Fig. 1: Critical base metal damage condition prior to heat treatment (Etched)

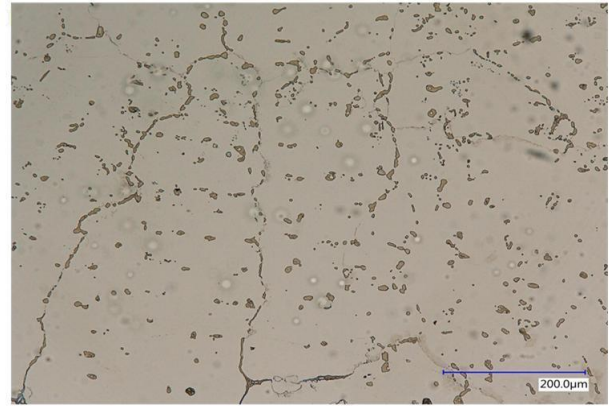


Fig. 2: Critical base metal damage confirmed at high magnification (Etched)

Specimen UNEW-ME-825091-03 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 UNEW-ME-825091-01) 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 requires Heavy Repair intervention with mandatory pre-weld heat treatment (Figs. 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. The 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.

## 10. PHOTOGRAPHS



Fig.1 Received as heavy damage condition



Fig.2 Received as heavy damage condition

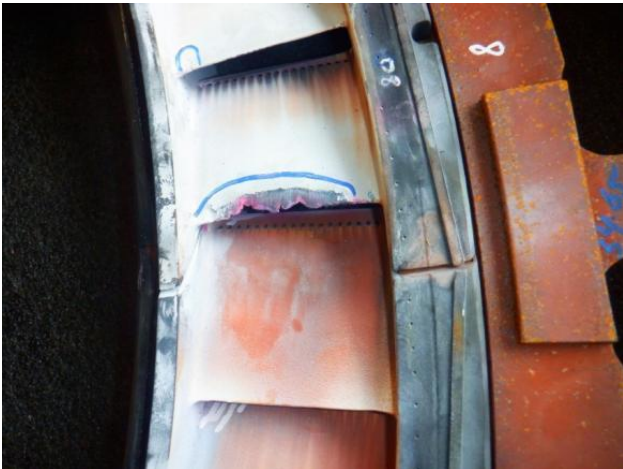


Fig.3 Received as heavy damage condition

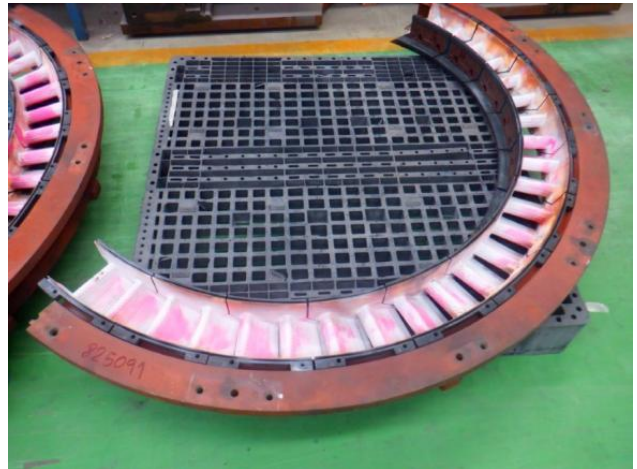


Fig.4 Received as heavy damage condition

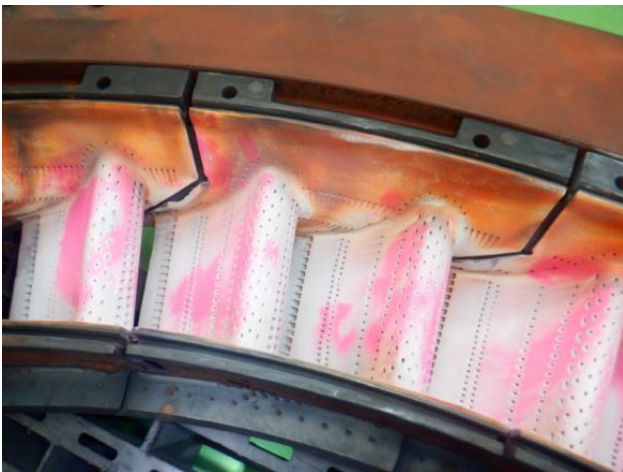


Fig.5 Received as heavy damage condition

Fig.6 Received as heavy damage condition



Fig.7 Received as heavy damage condition



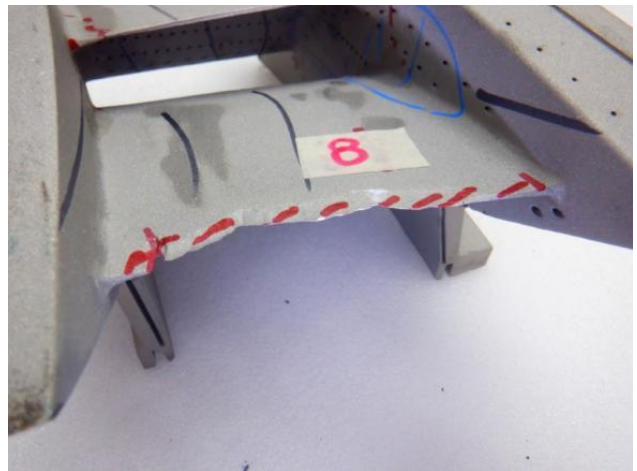
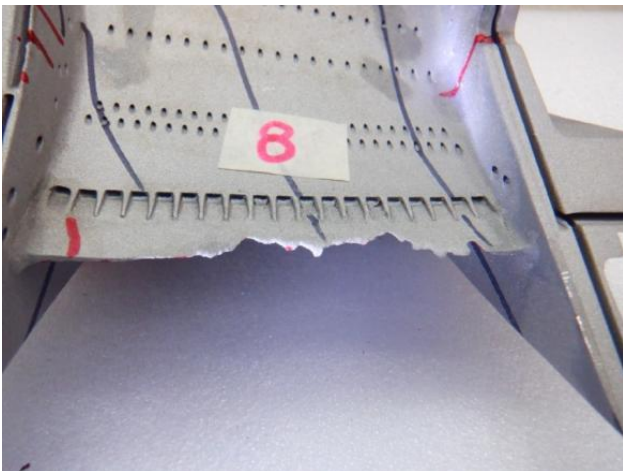
Fig.8 Received as heavy damage condition



Fig.9 Received as heavy damage condition



Fig.10 Received as heavy damage condition



# INCOMING INSPECTION REPORT

Fig.11 Extensive crack and heavy corrosion on trailing edge

Fig.12 Extensive crack and heavy corrosion on trailing edge

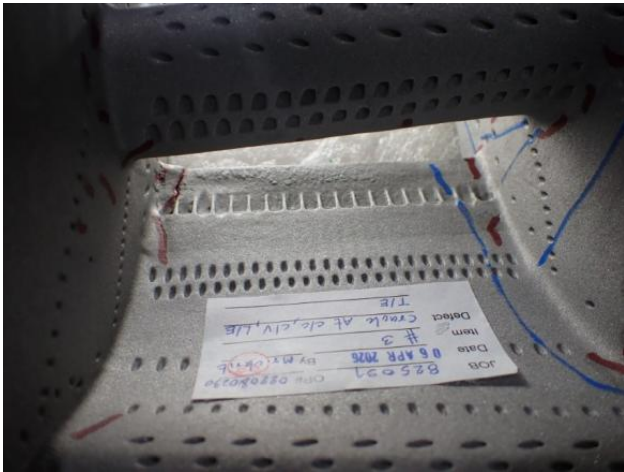


Fig.13 Extensive crack and heavy corrosion on trailing edge

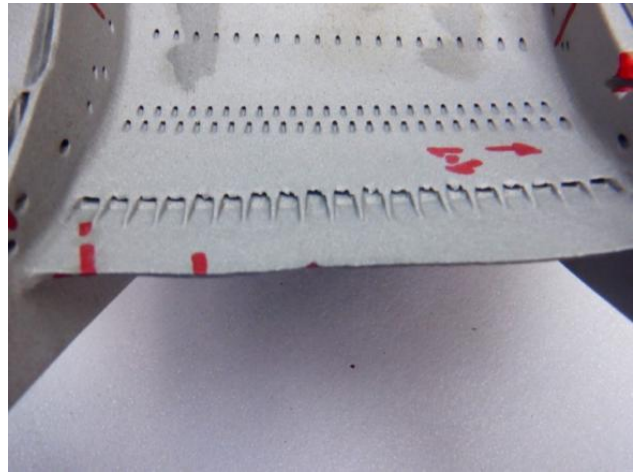


Fig.14 Heavy corrosion on concave airfoil and trailing edge

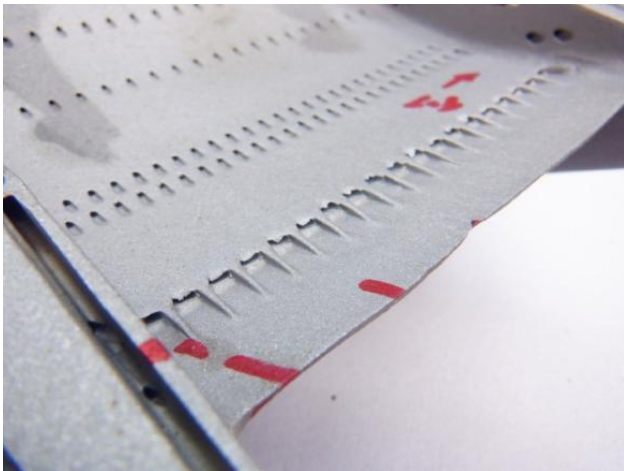


Fig.15 Heavy corrosion on concave airfoil and trailing edge

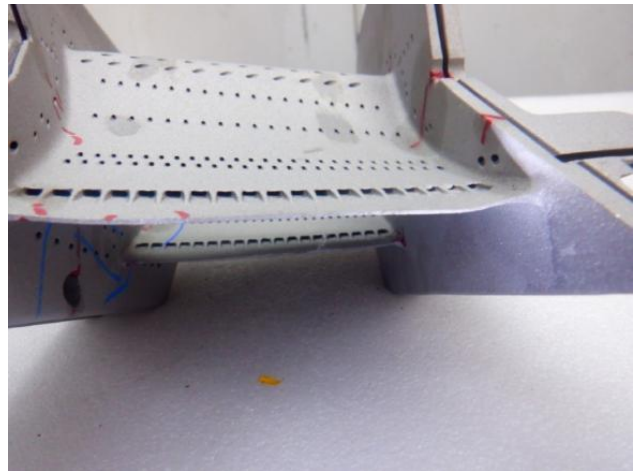


Fig.16 Critical bowing and thin wall on trailing edge



Fig.17 Heavy corrosion on outer shroud wall

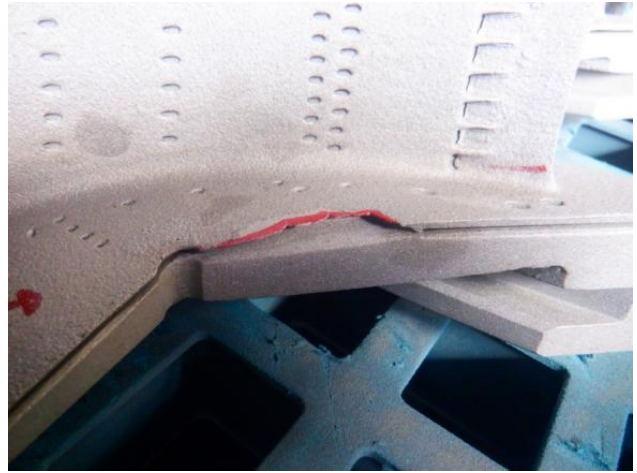


Fig.18 Heavy corrosion on outer shroud wall



Fig.19 As received condition of Impingement Cover plates



Fig.20 As received condition of Impingement Cover plates



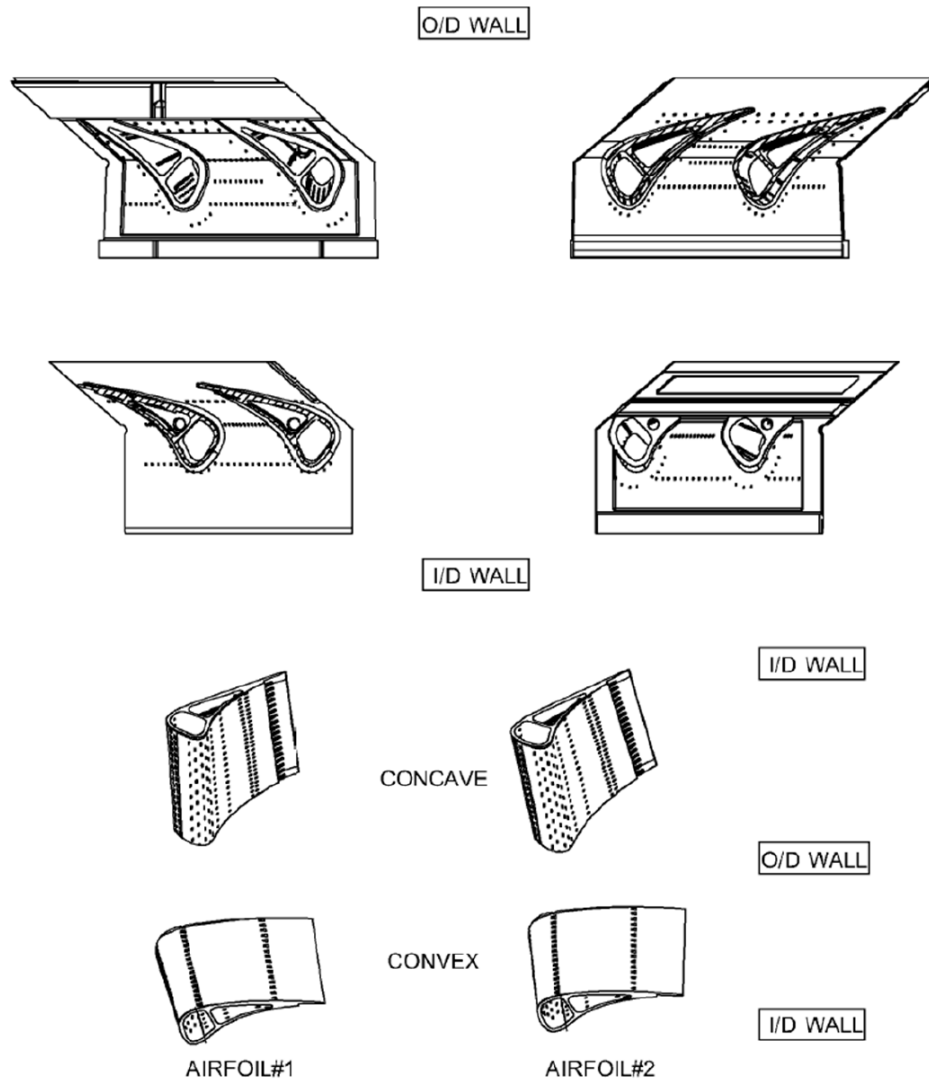
Fig.21 As received condition of core plugs



Fig.22 As received condition of core plugs

## 11. COMPONENT INSPECTION ZONES

The following reference drawing shows the nozzle segment inspection zones (O/D wall, I/D wall, concave and convex airfoil surfaces) used for defect recording during incoming inspection.

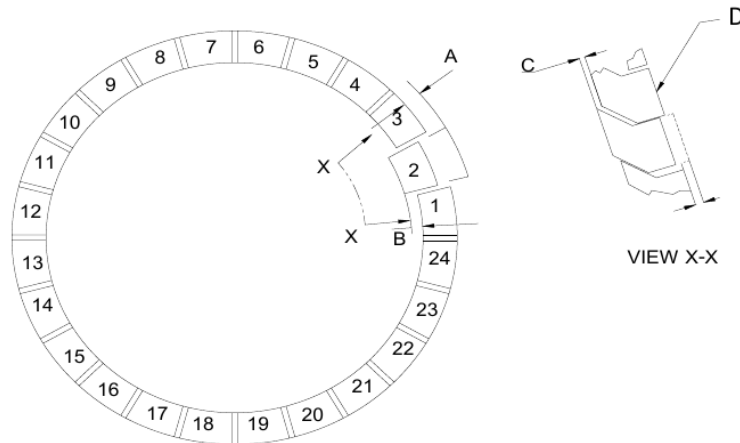


## 12. DIMENSION INSPECTION

### 12.1 ALIGNMENT CHECK

Segment numbering and measurement positions A, B (horizontal) and C, D (vertical) are shown below. All values in mm.

#### ALIGNMENT CHECK



| SEGMENT No. | A (Horiz.) | B (Horiz.) | C (Vert.) | D (Vert.) |
|-------------|------------|------------|-----------|-----------|
| 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       | 0.8       | 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       | 0.7       | 0.79      |
| 9-10        | 0.49       | 0.33       | 1.01      | 1.03      |
| 10-11       | 0.01       | 0.4        | 0.7       | 0.75      |
| 11-12       | 0.22       | 0.29       | 0.77      | 0.67      |
| 12-13       | 0.69       | 0.78       | 1.1       | 1.15      |
| 13-14       | 0.27       | 0.24       | 0.91      | 0.72      |
| 14-15       | 0.34       | 0.18       | 0.67      | 0.7       |
| 15-16       | 0.4        | 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       | 0.4        | 0.36       | 0.73      | 1.08      |
| 19-20       | 0.31       | 0.46       | 0.85      | 0.71      |

## INCOMING INSPECTION REPORT

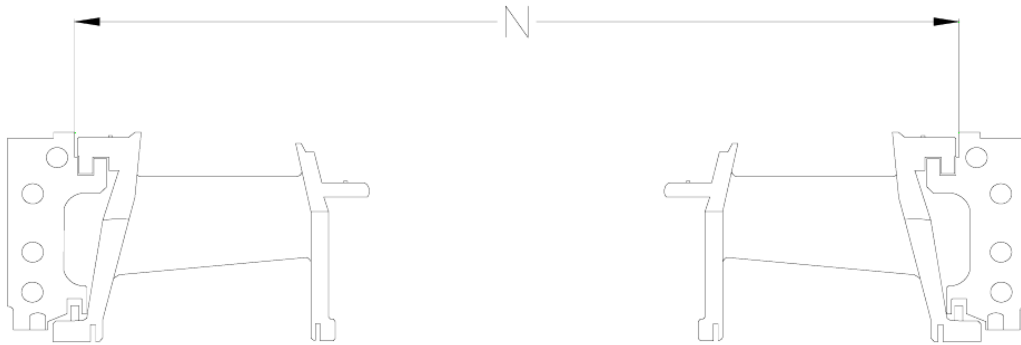


|       |      |      |      |      |
|-------|------|------|------|------|
| 20-21 | 0.2  | 0.41 | 1.04 | 0.93 |
| 21-22 | 0.49 | 0.28 | 0.66 | 0.98 |
| 22-23 | 0.35 | 0.35 | 0.93 | 0.82 |
| 23-24 | 0.39 | 0.11 | 0.48 | 0.64 |
| 24-1  | 0.88 | 0.71 | 0.93 | 0.78 |

*Note: Alignment step deviations are recorded against nominal (zero) datum as the incoming baseline.  
Straightening and dimensional requalification to final fits and clearances form part of the Heavy Repair scope;  
final acceptance is verified at post-repair dimensional inspection.*

## 12.2 ROUNDNESS CHECK

### ROUNDNESS CHECK



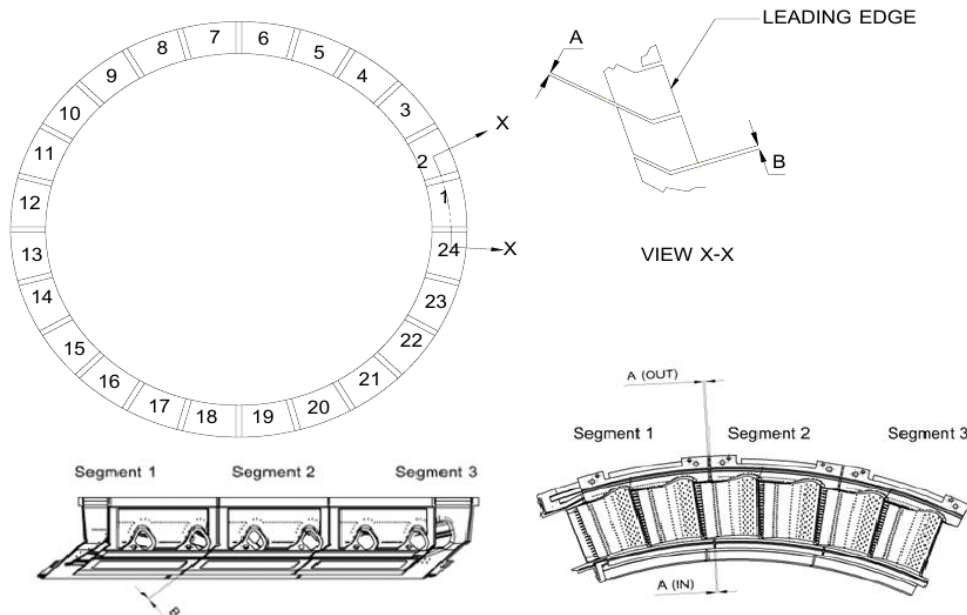
| No. | A-A    | B-B     | C-C    | D-D     | Roundness | Result |
|-----|--------|---------|--------|---------|-----------|--------|
| 1   | 1732.7 | 1733.42 | 1733.5 | 1732.95 | 0.8       | ACCEPT |

Unit: mm

### 12.3 GAP MEASUREMENT CHECK

Gap measurements at I/D and O/D walls, positions A and B. All values in mm.

#### GAP MEASUREMENT CHECK



| SEGMENT NO. | I/D Wall A | I/D Wall B | O/D Wall A | O/D Wall B |
|-------------|------------|------------|------------|------------|
| 1-2         | 2.98       | 4.28       | 2.83       | 3.26       |
| 2-3         | 3.53       | 3.78       | 3          | 3.73       |
| 3-4         | 3.22       | 4.08       | 3.07       | 5.49       |
| 4-5         | 3.66       | 4.47       | 3.48       | 4.8        |
| 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          | 3.6        | 2.47       | 4.41       |
| 14-15       | 3.87       | 4.15       | 3.18       | 4.45       |
| 15-16       | 2.58       | 4.1        | 2.33       | 5.53       |
| 16-17       | 3.59       | 4.3        | 3.24       | 4.57       |
| 17-18       | 3.01       | 3.71       | 2.54       | 4.1        |

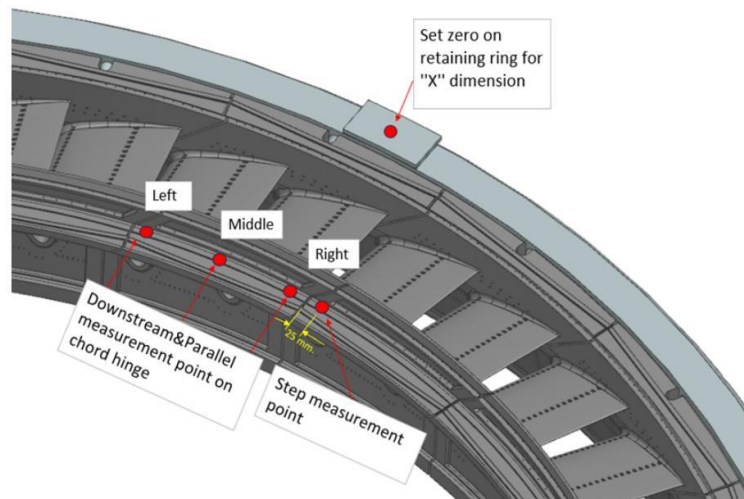
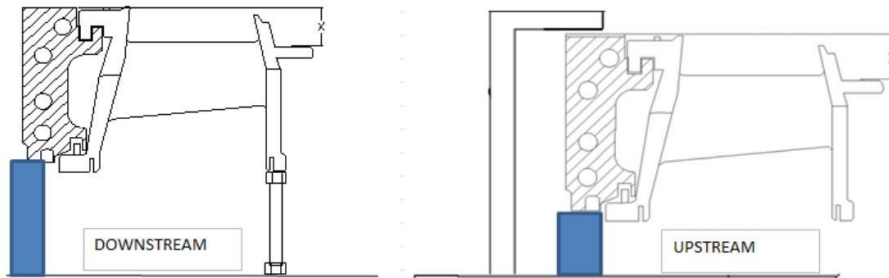
**INCOMING INSPECTION REPORT**

|       |      |      |      |      |
|-------|------|------|------|------|
| 18-19 | 3.58 | 4.58 | 3.2  | 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 | 3.6  |
| 22-23 | 3.66 | 3.65 | 3.52 | 3.7  |
| 23-24 | 3.28 | 3.88 | 2.32 | 4.64 |
| 24-1  | 3.87 | 4.13 | 3.82 | 5.19 |

## 12.4 DROP CHECK (DOWNSTREAM DEFLECTION)

Measurement positions on the chord hinge (Left, Middle, Right) with zero set on the retaining ring for the X dimension. All values in mm.

### DROP CHECK



# INCOMING INSPECTION REPORT

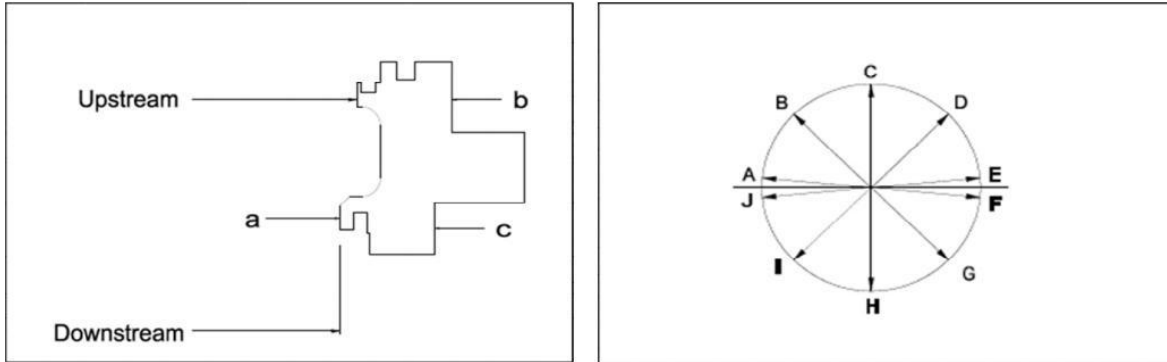


| Seg | X'Dn L | X'Dn M | X'Dn R | Paral. | Step  | X'Up L | X'Up M | X'Up R | Paral. | Step  | Flex L | Flex M | Flex R |
|-----|--------|--------|--------|--------|-------|--------|--------|--------|--------|-------|--------|--------|--------|
| 1   | 29.58  | 29.54  | 29.47  | -0.11  | 0.19  | 30.73  | 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   | 1.2    | 1.34   |
| 3   | 29.44  | 29.42  | 29.14  | -0.3   | -0.4  | 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 | 30.9   | 30.38  | 30.8   | -0.1   | 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  | 0.1    | 0.48  | 0.93   | 1.58   | 1.75   |
| 6   | 29.26  | 29.23  | 28.98  | -0.28  | -0.12 | 30.4   | 30.6   | 30.79  | 0.39   | 0.22  | 1.14   | 1.37   | 1.81   |
| 7   | 29.1   | 29.22  | 29.22  | 0.12   | -0.21 | 30.57  | 30.75  | 30.72  | 0.15   | -0.01 | 1.47   | 1.53   | 1.5    |
| 8   | 29.43  | 29.72  | 29.63  | 0.2    | 0.09  | 30.73  | 30.85  | 30.46  | -0.27  | -0.27 | 1.3    | 1.13   | 0.83   |
| 9   | 29.54  | 29.26  | 28.9   | -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  | 30.6   | 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   | 1.6    |
| 13  | 29.75  | 29.65  | 29.42  | -0.33  | 0.08  | 30.56  | 30.44  | 30.66  | 0.1    | 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   | 1.9    | 1.78   |
| 15  | 29.91  | 29.86  | 29.44  | -0.47  | 0.76  | 30.84  | 30.5   | 31     | 0.16   | 0.7   | 0.93   | 0.64   | 1.56   |
| 16  | 28.68  | 28.43  | 28.44  | -0.24  | -1.16 | 30.3   | 30.24  | 30.37  | 0.07   | -0.01 | 1.62   | 1.81   | 1.93   |
| 17  | 29.6   | 29.64  | 29.52  | -0.08  | 0.45  | 30.38  | 30.53  | 30.38  | 0      | -0.4  | 0.78   | 0.89   | 0.86   |
| 18  | 29.07  | 29.34  | 29.29  | 0.22   | -0.48 | 30.78  | 30.88  | 30.28  | -0.5   | -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   | 1.3    |
| 20  | 29.6   | 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  | 30.7   | 30.26  | -0.62  | -0.68 | 1.57   | 1.41   | 1.18   |
| 22  | 29.95  | 29.76  | 29.25  | -0.7   | -0.41 | 30.94  | 30.64  | 30.55  | -0.39  | 0.04  | 0.99   | 0.88   | 1.3    |
| 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  | 29.5   | 29.41  | -0.42  | -0.17 | 30.58  | 30.53  | 30.43  | -0.15  | -0.3  | 0.75   | 1.03   | 1.02   |

*Note: Drop check deflection and parallelism values are recorded against nominal (zero) datum as the incoming baseline; final acceptance is verified at post-repair dimensional requalification.*

## 12.5 RETAINING RING ROUNDNESS

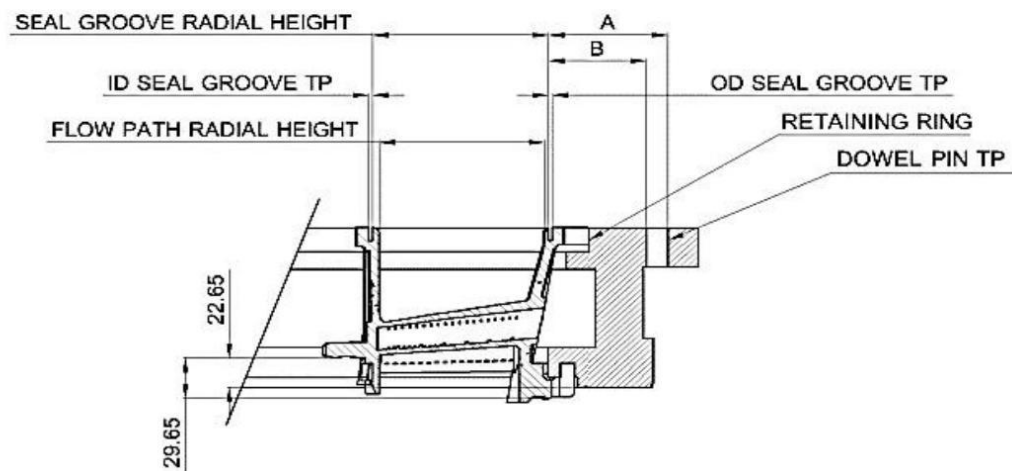
### RETAINING RING ROUNDNESS



| (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 | 1687.5  | 1688.24 | 1688.38 | 1687.79 | 1687.46 | 0.92    |

## 12.6 RADIAL HEIGHTS

### RADIAL HEIGHTS



| Item | Dowel OD to Outer seal groove (A) | Dowel ID to Outer wall flow path (B) |
|------|-----------------------------------|--------------------------------------|
| 1    | 86.48                             | 70.58                                |
| 2    | 87.78                             | 71.74                                |
| 3    | 86.57                             | 70.72                                |
| 4    | 87.06                             | 71.56                                |
| 5    | 86.6                              | 70.69                                |
| 6    | 87.14                             | 71.05                                |

**INCOMING INSPECTION REPORT**

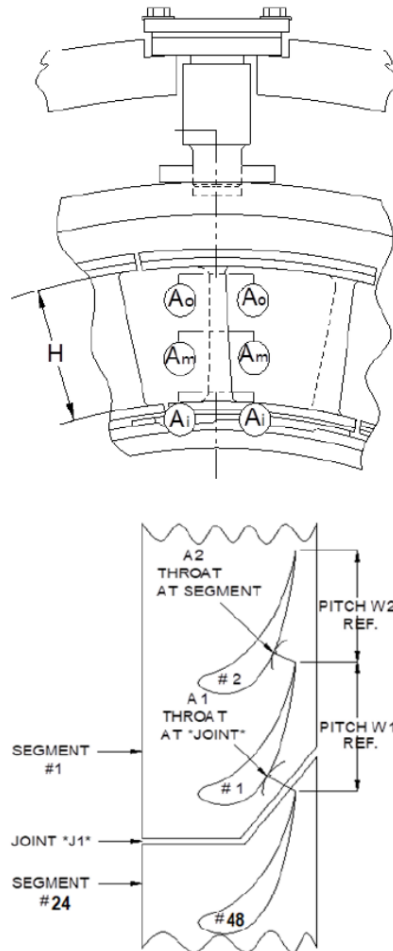
|    |       |       |
|----|-------|-------|
| 7  | 86.91 | 71.17 |
| 8  | 87.04 | 71.3  |
| 9  | 86.39 | 70.66 |
| 10 | 87.24 | 71.59 |
| 11 | 86.76 | 70.82 |
| 12 | 87.13 | 71.85 |

Unit: mm

## 12.7 HARMONIC ANALYSIS

Throat dimensions, pitch, and gas path areas were measured at all 48 throat positions (24 joints and 24 segments). Summary results:

### HARMONIC



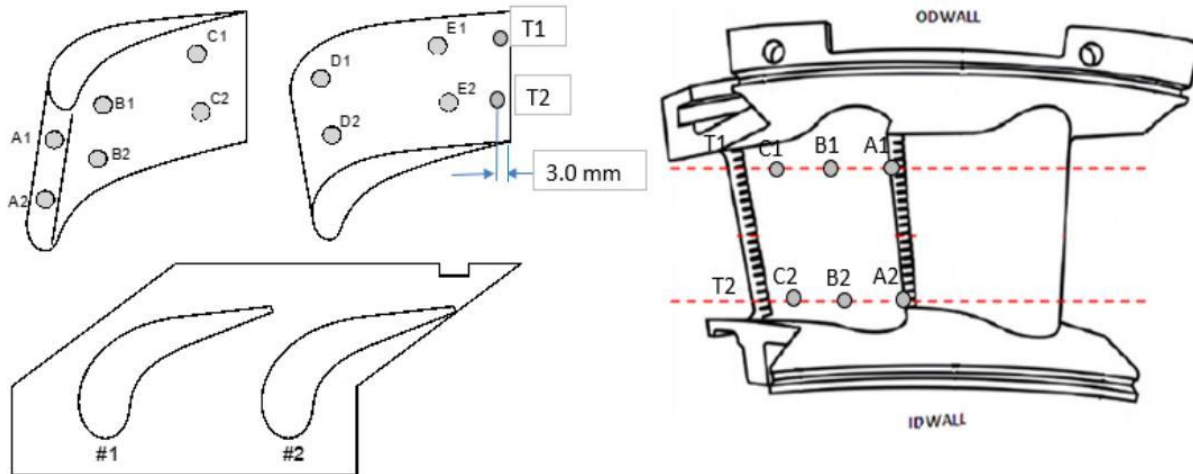
| Parameter                   | Result                                                |
|-----------------------------|-------------------------------------------------------|
| Total Joint Area            | 67,483.04 mm <sup>2</sup> (104.599 in <sup>2</sup> )  |
| Total Segment Area          | 64,641.03 mm <sup>2</sup> (100.194 in <sup>2</sup> )  |
| Total Nozzle Area           | 132,124.07 mm <sup>2</sup> (204.793 in <sup>2</sup> ) |
| % Area Deviation            | 0.33%                                                 |
| Individual throat deviation | All within plus or minus 10% acceptance range         |

The complete 48 position harmonic data set (throat dimensions AO, AM, AI, H at centre, pitch WM and WO, gas path area, and harmonic values with percentage deviations) is retained in the UNEW inspection record for Job Order 825091 and is available on request.

## 12.8 WALL THICKNESS CHECK

Ultrasonic wall thickness measurement positions A1 to E2 and trailing edge positions T1 and T2 (minimum limit 2.03 mm at T1 and T2). All values in mm.

### WALL THICKNESS CHECK



### Airfoil # 1:

| Seg | A1   | A2   | B1   | B2   | C1   | C2   | D1   | D2   | E1   | E2   | T1   | T2   | Result |
|-----|------|------|------|------|------|------|------|------|------|------|------|------|--------|
| 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 | Rej    |
| 2   | 2.68 | 2.97 | 2.52 | 2.81 | 2.27 | 2.22 | 3.82 | 3.68 | 3.6  | 2.96 | 1.99 | 2.05 | Rej    |
| 3   | 2.87 | 2.82 | 2.69 | 2.78 | 2.41 | 2.3  | 3.16 | 2.68 | 2.79 | 2.36 | 1.36 | 1.68 | Rej    |
| 4   | 3.05 | 3.07 | 2.55 | 2.68 | 2.45 | 2.92 | 3.18 | 3.11 | 3.44 | 3.17 | 1.9  | 2.26 | Rej    |
| 5   | 2.88 | 3.11 | 2.71 | 3.15 | 2.3  | 2.48 | 3.36 | 3.51 | 3.51 | 3.44 | 1.25 | 1.26 | Rej    |
| 6   | 3.03 | 3.39 | 3.16 | 3.23 | 3.18 | 3.45 | 3.2  | 3.46 | 3.69 | 3.52 | 1.75 | 1.9  | Rej    |
| 7   | 3.05 | 3.24 | 2.46 | 2.94 | 2.36 | 2.7  | 3.58 | 2.75 | 2.95 | 2.85 | 1.29 | 1.53 | Rej    |
| 8   | 3.02 | 3.76 | 2.62 | 2.98 | 2.24 | 2.46 | 3.55 | 3.02 | 3.39 | 3.13 | 1.8  | 1.96 | Rej    |
| 9   | 3.03 | 3.48 | 2.6  | 2.89 | 2.65 | 2.94 | 3.53 | 3.18 | 3.54 | 3.21 | 1.37 | 1.38 | Rej    |
| 10  | 2.96 | 3.39 | 2.48 | 2.73 | 2.42 | 2.47 | 3.29 | 3.52 | 3.45 | 3.43 | 1.52 | 1.6  | Rej    |
| 11  | 3.06 | 3.6  | 2.78 | 2.96 | 2.27 | 2.46 | 3.95 | 3.55 | 3.03 | 3.12 | 1.73 | 2.1  | 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 | Rej    |
| 13  | 3.03 | 3.55 | 2.28 | 2.48 | 2.68 | 2.54 | 3.29 | 2.86 | 3.7  | 3.23 | 1.65 | 1.61 | Rej    |
| 14  | 3.02 | 3.45 | 2.57 | 2.68 | 2.56 | 2.3  | 3.21 | 3.16 | 3.35 | 3.29 | 1.27 | 1.5  | Rej    |
| 15  | 2.96 | 2.93 | 2.53 | 2.79 | 2.4  | 2.48 | 3.55 | 3.26 | 2.8  | 3.11 | 1.56 | 1.73 | 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 | 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 | Rej    |
| 18  | 2.95 | 3.24 | 2.32 | 2.61 | 2.4  | 2.82 | 3.18 | 2.96 | 2.95 | 2.8  | 1.5  | 1.6  | 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 | 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 | Rej    |
| 21  | 3.03 | 3.34 | 2.62 | 2.8  | 2.61 | 2.77 | 3.33 | 2.86 | 3.55 | 2.93 | 1.29 | 1.62 | Rej    |

## INCOMING INSPECTION REPORT



|    |      |      |      |      |      |      |      |      |      |      |      |      |     |
|----|------|------|------|------|------|------|------|------|------|------|------|------|-----|
| 22 | 2.8  | 3.04 | 2.66 | 3.07 | 2.44 | 2.55 | 3.55 | 3.33 | 2.98 | 2.9  | 1.39 | 1.45 | Rej |
| 23 | 2.9  | 2.92 | 2.46 | 2.77 | 2.43 | 2.66 | 3.64 | 3.42 | 3.32 | 3.11 | 1.52 | 1.58 | 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 | Rej |

**Airfoil # 2:**

| Seg | A1   | A2   | B1   | B2   | C1   | C2   | D1   | D2   | E1   | E2   | T1          | T2          | Result |
|-----|------|------|------|------|------|------|------|------|------|------|-------------|-------------|--------|
| 1   | 2.84 | 2.86 | 2.44 | 2.63 | 2.38 | 2.49 | 3.74 | 3.22 | 2.85 | 2.92 | 1.5         | 1.22        | Rej    |
| 2   | 3.02 | 3.11 | 2.98 | 2.95 | 2.56 | 2.64 | 3.51 | 3.33 | 3.4  | 3.35 | 1.71        | 2.06        | Rej    |
| 3   | 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   | 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   | 2.91 | 3.04 | 2.6  | 2.48 | 2.48 | 2.76 | 3.37 | 3.3  | 3.11 | 3.09 | 1.63        | 1.6         | Rej    |
| 6   | 3.02 | 3.45 | 2.91 | 3.2  | 3.01 | 3.11 | 3.57 | 3.42 | 4.15 | 3.93 | 1.94        | 1.93        | Rej    |
| 7   | 2.64 | 3.23 | 2.5  | 2.94 | 2.59 | 2.97 | 3.5  | 2.83 | 3.14 | 3.23 | 1.74        | 1.68        | Rej    |
| 8   | 3.01 | 3.62 | 2.36 | 2.78 | 2.47 | 3.12 | 3.48 | 3.12 | 3.76 | 3.8  | Missin<br>g | Missin<br>g | Rej    |
| 9   | 2.93 | 3.43 | 2.57 | 2.97 | 2.55 | 3.14 | 3.75 | 3.16 | 3.32 | 3.12 | 1.3         | 1.43        | Rej    |
| 10  | 2.98 | 3.41 | 2.81 | 3.17 | 2.35 | 2.6  | 3.43 | 3.03 | 3.44 | 3.08 | 1.86        | 1.88        | Rej    |
| 11  | 2.94 | 3.15 | 2.63 | 2.68 | 2.27 | 2.51 | 3.32 | 3.42 | 3.55 | 3.4  | 1.93        | 1.79        | Rej    |
| 12  | 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  | 3.02 | 3.06 | 2.44 | 2.53 | 2.57 | 2.63 | 3.57 | 2.85 | 3.52 | 3.44 | 1.6         | 1.36        | Rej    |
| 14  | 3.01 | 3.47 | 2.68 | 2.48 | 2.3  | 2.5  | 3.21 | 3.04 | 3.42 | 3.38 | 1.4         | 1.18        | Rej    |
| 15  | 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  | 2.98 | 3.04 | 2.47 | 2.61 | 2.55 | 2.64 | 3.38 | 3.45 | 3.05 | 2.82 | 1.68        | 1.7         | Rej    |
| 17  | 3.05 | 3.11 | 2.24 | 2.48 | 2.3  | 2.55 | 3.29 | 2.97 | 3.54 | 3.3  | 1.56        | 1.68        | Rej    |
| 18  | 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  | 3.03 | 3.12 | 2.6  | 2.87 | 2.56 | 3    | 3.35 | 3.34 | 3.31 | 3.45 | 1.5         | 1.56        | Rej    |
| 20  | 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  | 3.06 | 3.4  | 2.72 | 3.03 | 2.28 | 2.43 | 3.27 | 2.95 | 3.22 | 3.38 | 1.21        | 1.12        | Rej    |
| 22  | 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  | 2.95 | 3.13 | 2.63 | 3.03 | 2.87 | 3.02 | 3.64 | 3.42 | 3.41 | 3.59 | 1.52        | 1.41        | Rej    |
| 24  | 2.91 | 3.14 | 2.74 | 3.14 | 2.57 | 2.7  | 3.44 | 3.06 | 3.1  | 3.08 | 1.53        | 1.38        | Rej    |

**Note: Based on incoming wall thickness dimensional inspection, positions T1 and T2 are non-conforming against the 2.03 mm minimum limit on all 24 segments: 89 of 94 measurable readings are below the limit and 2 positions are unmeasurable due to through-wall material loss (Item 8). This requires PSP application for trailing edge wall thickness restoration on all 48 airfoil trailing edge positions.**

### 13. PER-SEGMENT DISPOSITION SUMMARY

Per-segment inspection dispositions are summarized below. B = Blend repair. TPR = Transient Phase Restoration. REJ = Dimension unacceptable, repair required.

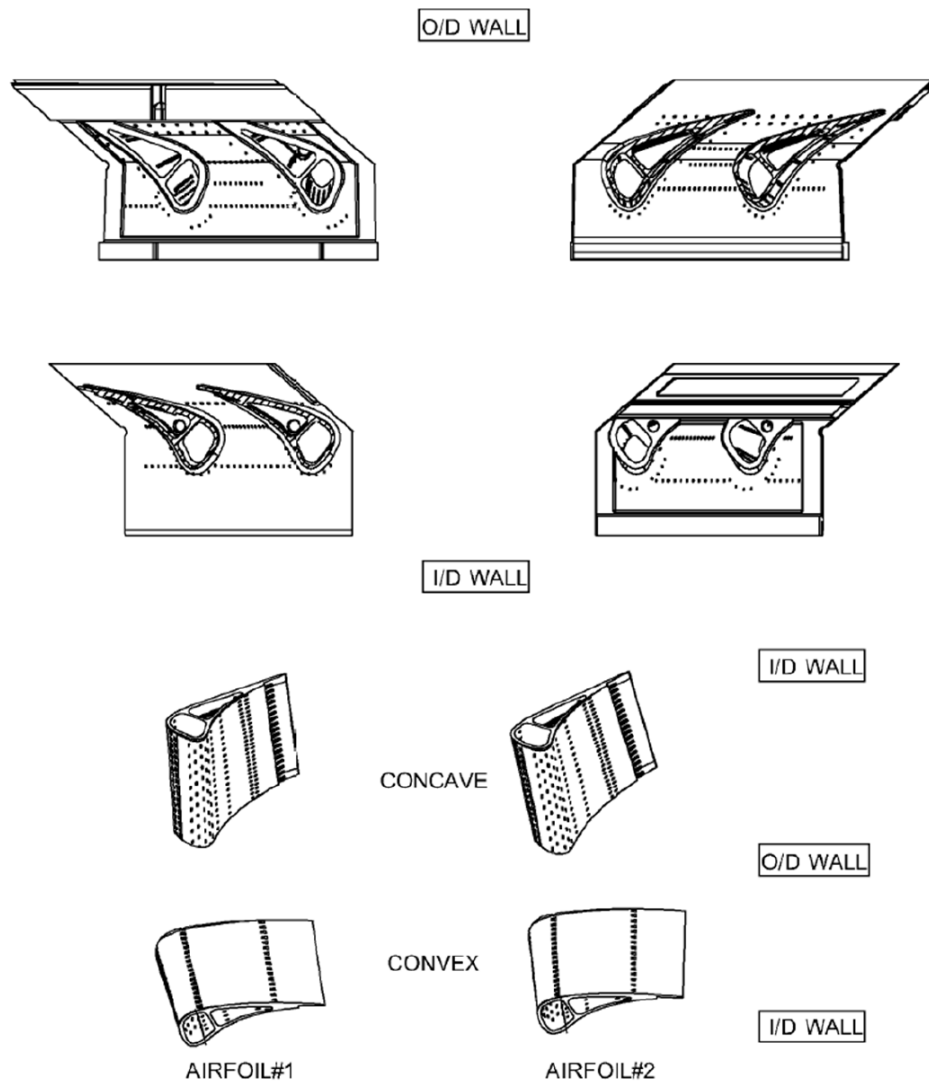
| Item | Serial Number | Airfoil Cracking | Shroud Cracking | Corrosion | T/E Wall Thickness |
|------|---------------|------------------|-----------------|-----------|--------------------|
| 1    | A1FC 04959    | TPR              | TPR             | B         | REJ                |
| 2    | A1FC 04965    | TPR              | TPR             | B         | REJ                |
| 3    | A1FC 04999    | TPR              | TPR             | B         | REJ                |
| 4    | A1FC 04981    | TPR              | TPR             | B         | REJ                |
| 5    | A1FC 04978    | TPR              | TPR             | B         | REJ                |
| 6    | A1FC 04958    | TPR              | TPR             | B         | REJ                |
| 7    | A1FC 04964    | TPR              | TPR             | B         | REJ                |
| 8    | A1FC 04955    | TPR              | TPR             | B         | REJ                |
| 9    | A1FC 04963    | TPR              | TPR             | B         | REJ                |
| 10   | A1FC 05000    | TPR              | TPR             | B         | REJ                |
| 11   | A1FC 04957    | TPR              | TPR             | B         | REJ                |
| 12   | A1FC 05002    | TPR              | TPR             | B         | REJ                |
| 13   | A1FC 04962    | TPR              | TPR             | B         | REJ                |
| 14   | A1FC 05007    | TPR              | TPR             | B         | REJ                |
| 15   | A1FC 05004    | TPR              | TPR             | B         | REJ                |
| 16   | A1FC 04960    | TPR              | TPR             | B         | REJ                |
| 17   | A1FC 04956    | TPR              | TPR             | B         | REJ                |
| 18   | A1FC 05003    | TPR              | TPR             | B         | REJ                |
| 19   | A1FC 04945    | TPR              | TPR             | B         | REJ                |
| 20   | A1FC 04998    | TPR              | TPR             | B         | REJ                |
| 21   | A1FC 05006    | TPR              | TPR             | B         | REJ                |
| 22   | A1FC 05001    | TPR              | TPR             | B         | REJ                |
| 23   | A1FC 04996    | TPR              | TPR             | B         | REJ                |
| 24   | A1FC 04961    | TPR              | TPR             | B         | REJ                |

Exceptions and non-typical findings: Item 8 (A1FC 04955), through-wall missing material 8x100 mm at the trailing edge. Item 19 (A1FC 04945), 50 mm crack at the concave airfoil face. Items 1, 2, 4, 5, 6, 11, 14, 15, 17, missing material patches at the O/D wall requiring GTAW weld build-up.

## 14. DEFECT MAP RECORD

Defect locations recorded during incoming inspection are summarized below against the component inspection zone reference of Section 11. This record consolidates the incoming defect mapping for the complete set of 24 segments.

|                              |                                                                                      |
|------------------------------|--------------------------------------------------------------------------------------|
| <b>Component</b>             | MS6001FA 1st Stage Nozzle, 24 Segments (1 Complete Set)                              |
| <b>Part Number (Casting)</b> | 129E9734 P002                                                                        |
| <b>Customer</b>              | Nghi Son Refinery & Petrochemical, LLC.                                              |
| <b>Customer P.O. No.</b>     | 1003986864                                                                           |
| <b>UNEW Job Order No.</b>    | 825091                                                                               |
| <b>Record Date</b>           | 27 April 2026                                                                        |
| <b>Recorded By</b>           | UNEW Incoming Inspection; reviewed and approved by Paul McGuire, Engineering Manager |



## DEFECT LOCATION SUMMARY

| Zone / Location                                       | Defect / Condition                   | Size Range                      | Items Affected                      |
|-------------------------------------------------------|--------------------------------------|---------------------------------|-------------------------------------|
| Trailing edge, O/D wall side                          | Cracking                             | 5 to 75 mm                      | Items 1 to 24                       |
| Trailing edge, I/D wall side                          | Cracking                             | 5 to 25 mm                      | Items 1 to 24                       |
| Airfoil body (concave, convex, LE, T/E)               | Multi-crack networks                 | 15x40 to 30x120 mm <sup>2</sup> | Items 1 to 24                       |
| I/D wall, non-gas path                                | Cracking                             | 8 to 20 mm                      | Items 1 to 24                       |
| O/D wall, non-gas path                                | Cracking                             | 8 to 15 mm                      | Items 1, 3, 22, 23                  |
| O/D wall                                              | Missing material                     | 5x30 to 8x50 mm                 | Items 1, 2, 4, 5, 6, 11, 14, 15, 17 |
| Trailing edge                                         | Through-wall missing material        | 8x100 mm                        | Item 8                              |
| Concave airfoil face                                  | Crack                                | 50 mm                           | Item 19                             |
| Concave airfoil, trailing edge, and outer shroud wall | Heavy oxidation and hot corrosion    | Widespread                      | Items 1 to 24                       |
| I/D wall, non-gas path                                | Light to medium corrosion            | Surface                         | Items 1 to 24                       |
| All gas path surfaces                                 | Coating deterioration (TBC + MCrAlY) | Full gas path                   | Items 1 to 24                       |
| Trailing edge, airfoil                                | Bowing and permanent deformation     | Per Section 12                  | Items 1 to 24                       |

*Metallurgical sectioning locations: coupons were removed at Item 13 (inner shroud, report UNEW-ME-825091-01), Item 11 (inner shroud, report UNEW-ME-825091-02), and Item 8 (trailing edge, report UNEW-ME-825091-03). Results are given in Section 9.*

*Defect sizes and item allocations above correspond to the disposition actions of Sections 5.1 and 13 and the dimensional records of Section 12.*

# ANNEX A - QUANTIFIED HEAVY REPAIR WORK SCOPE

## 1ST STAGE NOZZLE

*Annex to Incoming Inspection Report, WO1003986864*

|                              |                                       |                             |                                                   |
|------------------------------|---------------------------------------|-----------------------------|---------------------------------------------------|
| <b>Customer</b>              | Nghi Son Refinery & Petrochemical LLC | <b>Report Date</b>          | 27 April 2026                                     |
| <b>Customer P.O. No.</b>     | WO1003986864                          | <b>UNEW Work Order</b>      | 825091                                            |
| <b>Engine Type</b>           | MS6001FA (GE Frame 6FA)               | <b>Component</b>            | 1st Stage Nozzle                                  |
| <b>Component Part No.</b>    | 143E5711G02                           | <b>Qty. Received</b>        | 24 segments (1 complete set)                      |
| <b>Repair Classification</b> | <b>HEAVY REPAIR</b>                   | <b>UNEW Repair Severity</b> | <b>Level 9 of 10 (Very Heavy, upper boundary)</b> |

### 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 (Very Heavy, upper boundary), 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 segment, 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 segment. The feature counts below establish the multiplier applied throughout this Annex.

| Feature               | Per segment | Complete set | Source in the incoming inspection report                  |
|-----------------------|-------------|--------------|-----------------------------------------------------------|
| <b>Nozzle segment</b> | 1           | 24           | Section 7, serial correlation, 24 segments received       |
| <b>Airfoil</b>        | 2           | 48           | Section 3.4, 24 segments x 2 airfoils = 48 trailing edges |

## ANNEX A - QUANTIFIED HEAVY REPAIR WORK SCOPE

| Feature                                   | Per segment | Complete set | Source in the incoming inspection report            |
|-------------------------------------------|-------------|--------------|-----------------------------------------------------|
| Trailing edge wall thickness position     | 4           | 96           | Section 3.4, 24 segments x 2 airfoils x T1 and T2   |
| Segment joint seal position               | 8           | 192          | Section 3.9, item 1, 192 of 192 replaced            |
| Leading edge core plug (inner and outer)  | 4           | 96           | Section 3.9, items 4 and 5, 48 of 48 each           |
| Trailing edge core plug                   | 2           | 48           | Section 3.9, item 6, 48 of 48                       |
| Impingement cover plate (inner and outer) | 2           | 48           | Section 3.9, items 2 and 3, 24 of 24 each           |
| Internal retaining ring                   | 1           | 24           | Section 3.9, item 7, 24 of 24                       |
| Pressure Side Plate position              | 2           | 48           | Section 3.4, 48 of 48 airfoil trailing edges REJECT |

### A3. RECORDED FINDINGS AND REQUIRED RESTORATION

| Finding                                        | Recorded extent                        | Restoration required                | Locations |
|------------------------------------------------|----------------------------------------|-------------------------------------|-----------|
| Trailing edge cracking, O/D wall               | Cracks 5 to 75 mm confirmed by FPI     | Items 1 to 24                       | 24        |
| Trailing edge cracking, I/D wall               | Cracks 5 to 25 mm confirmed by FPI     | Items 1 to 24                       | 24        |
| Non gas path cracking, I/D wall                | Cracks 8 to 20 mm                      | Items 1 to 24                       | 24        |
| Non gas path cracking, O/D wall                | Cracks 8 to 15 mm                      | Items 1, 3, 22 and 23               | 4         |
| Single large crack at concave airfoil          | Crack 50 mm, non typical defect        | Item 19                             | 1         |
| Missing material at O/D wall                   | Patches 5 x 30 mm to 8 x 50 mm         | Items 1, 2, 4, 5, 6, 11, 14, 15, 17 | 9         |
| Through wall missing material at trailing edge | 8 x 100 mm, through wall material loss | Item 8, S/N A1FC 04955              | 1         |
| <b>TOTAL GTAW WELD REPAIR ZONES</b>            |                                        |                                     | <b>87</b> |

## ANNEX A - QUANTIFIED HEAVY REPAIR WORK SCOPE

| Finding                                                                         | Recorded extent                                                                | Restoration required             | Locations  |
|---------------------------------------------------------------------------------|--------------------------------------------------------------------------------|----------------------------------|------------|
| <b>Airfoil body multi cracking, concave, convex, leading and trailing edges</b> | Crack networks 15 x 40 mm to 30 x 120 mm, Transient Phase Restoration required | All 24 segments, 2 airfoils each | 48         |
| <b>TOTAL WELD AND TPR AREAS ACROSS THE SET</b>                                  |                                                                                |                                  | <b>135</b> |

### 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.      |
|-------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-----------|
| <b>Trailing edge wall thickness, T1 and T2</b>              | REJECT on 24 of 24 segments and 48 of 48 airfoils. 89 of 94 measurable readings below the 2.03 mm minimum. Lowest 1.12 mm, 44.8 percent below limit. Mean 1.57 mm, 22.6 percent below limit. 2 positions unmeasurable due to through wall loss. | Pressure Side Plate structural restoration at all 48 airfoil trailing edge positions | 48        |
| <b>Trailing edge bowing and permanent deformation</b>       | Confirmed across the full set                                                                                                                                                                                                                   | Cold straightening and plannishing before weld repair                                | 48        |
| <b>TOTAL STRUCTURAL AND GEOMETRY RESTORATION OPERATIONS</b> |                                                                                                                                                                                                                                                 |                                                                                      | <b>96</b> |

## ANNEX A - QUANTIFIED HEAVY REPAIR WORK SCOPE

### A5. REPAIR ROUTE WITH WORK QUANTITY

| Step | Process, applies to all 24 segments                                                        | Work quantity across the set                                                                | Ops. |
|------|--------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|------|
| 1    | Receipt inspection, serial number recording, dimensional and harmonic baseline measurement | 24 receipt inspections, 24 dimensional baselines, 1 harmonic baseline for the set           | 49   |
| 1a   | Post strip ultrasonic wall thickness inspection at the defined T1 and T2 positions         | 96 defined positions, 94 measurable                                                         | 96   |
| 2    | Chemical strip of external gas path coatings, heat tint verification for full removal      | 24 chemical strips and 24 heat tint verifications                                           | 48   |
| 3    | Incoming solution heat treatment in full vacuum environment, pre weld condition            | 24 furnace exposures, cycle 1 of 2                                                          | 24   |
| 4    | Post heat treatment FPI and visual inspection, record all defects per defect chart         | 24 FPI events and 24 visual inspections                                                     | 48   |
| 5    | Cold straightening and planishing of trailing edge and airfoil sections                    | 48 airfoil trailing edge sections                                                           | 48   |
| 6    | Blend to remove oxidation, corrosion and surface defects                                   | 24 trailing edge and concave faces, 24 outer shroud walls, 24 I/D and non gas path surfaces | 72   |
| 7    | Prep and GTAW weld repair, all areas of major structural cracking and missing material     | 87 weld zones, GTAW with FSX-414 compatible filler                                          | 87   |
| 7a   | Pre weld fluorescent penetrant inspection at every weld area (Section 5.1 NOTE, mandatory) | 87 weld zones                                                                               | 87   |
| 8    | Local FPI, post weld verification before heat treatment                                    | 87 weld zones                                                                               | 87   |
| 9    | Transient Phase Restoration, all areas of multi cracking                                   | 48 airfoil crack networks                                                                   | 48   |
| 9a   | Pre and post Transient Phase Restoration FPI (Section 5.1 NOTE, mandatory)                 | 48 areas, before and after                                                                  | 96   |
| 10   | Solution heat treatment in full vacuum environment, post repair                            | 24 furnace exposures, cycle 2 of 2                                                          | 24   |
| 11   | Post repair FPI and visual inspection                                                      | 24 FPI events and 24 visual inspections                                                     | 48   |

## ANNEX A - QUANTIFIED HEAVY REPAIR WORK SCOPE

| Step | Process, applies to all 24 segments                                                   | Work quantity across the set                                                   | Ops. |
|------|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|------|
| 12   | Apply Pressure Side Plate for trailing edge wall thickness restoration                | 48 plates fabricated, 48 fitted and welded, 48 blended to aerofoil contour     | 144  |
| 13   | EDM to restore cooling holes and seal slots                                           | 24 segments                                                                    | 24   |
| 14   | Ultrasonic wall thickness inspection, confirm trailing edge meets the 2.03 mm minimum | 96 defined positions re verified after restoration                             | 96   |
| 15   | Pre coating dimensional inspection and cooling hole flow check                        | 24 dimensional inspections and 24 flow checks                                  | 48   |
| 16   | Abrasive blast surface preparation, apply HVOF MCrAlY bond coat and full TBC top coat | 24 blasts, 24 bond coat applications, 24 top coat applications                 | 72   |
| 16a  | Post coating visual inspection of all coated surfaces                                 | 24 segments                                                                    | 24   |
| 17   | Re install core plugs and cover plates; visual inspect fabrication welds              | 144 core plugs, 48 impingement cover plates, 24 visual inspections             | 216  |
| 18   | Final assembly, dimensional inspection, harmonic and roundness check                  | 24 dimensional inspections, 1 harmonic and roundness check of the complete set | 25   |
| 19   | Weld in place nozzle retaining pins; final visual inspection                          | 24 pin welds and 24 final visual inspections                                   | 48   |
| 20   | Compile Final Report, pack and ship with all required documentation                   | 24 segments, 1 set documentation package                                       | 25   |

## ANNEX A - QUANTIFIED HEAVY REPAIR WORK SCOPE

### 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                                               | Post strip ultrasonic wall thickness inspection at the defined T1 and T2 positions         | 1a         | 96         |
| 2                                               | Post heat treatment FPI and visual inspection, record all defects per defect chart         | 4          | 48         |
| 3                                               | Pre weld fluorescent penetrant inspection at every weld area (Section 5.1 NOTE, mandatory) | 7a         | 87         |
| 4                                               | Local FPI, post weld verification before heat treatment                                    | 8          | 87         |
| 5                                               | Pre and post Transient Phase Restoration FPI (Section 5.1 NOTE, mandatory)                 | 9a         | 96         |
| 6                                               | Post repair FPI and visual inspection                                                      | 11         | 48         |
| 7                                               | Ultrasonic wall thickness inspection, confirm trailing edge meets the 2.03 mm minimum      | 14         | 96         |
| 8                                               | Pre coating dimensional inspection and cooling hole flow check                             | 15         | 48         |
| 9                                               | Post coating visual inspection of all coated surfaces                                      | 16a        | 24         |
| <b>TOTAL INSPECTION AND VERIFICATION EVENTS</b> |                                                                                            |            | <b>630</b> |

## ANNEX A - QUANTIFIED HEAVY REPAIR WORK SCOPE

### A7. HARDWARE AND RESTORATION CENSUS

| Disposition                                         | Quantity                | Detail                                                                                                                                                    |
|-----------------------------------------------------|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Replaced with new</b>                            | 430 detail parts        | 192 segment joint seals, 96 leading edge core plugs, 48 trailing edge core plugs, 48 impingement cover plates, 24 internal retaining rings, 22 heli coils |
| <b>Fabricated and fitted new</b>                    | 48 Pressure Side Plates | Structural trailing edge restoration at all 48 airfoil positions, recorded as an Additional work item                                                     |
| <b>Re used</b>                                      | None                    | No wear exposed hardware on this set was recorded as fit to return to service                                                                             |
| <b>TOTAL DETAIL PARTS FITTED NEW ACROSS THE SET</b> | <b>478</b>              |                                                                                                                                                           |

### A8. WORK VOLUME OF THE REQUIRED REPAIR SCOPE

| Work category                                                 | Controlled operations |
|---------------------------------------------------------------|-----------------------|
| Cleaning, coating removal and material preparation            | 169                   |
| Structural weld repair, weld build up and profile restoration | 135                   |
| Structural wall restoration and cooling system recovery       | 168                   |
| Geometry restoration, machining and mechanical correction     | 48                    |
| Heat treatment, furnace cycles                                | 48                    |
| Inspection, verification and hold point control               | 630                   |
| Coating application and acceptance                            | 72                    |
| Receipt, assembly, documentation and release control          | 314                   |
| <b>TOTAL CONTROLLED OPERATIONS</b>                            | <b>1,584</b>          |

The Heavy Repair scope required by this set consists of 1,584 controlled operations across 24 segments. It includes 87 GTAW weld repair zones and 48 Transient Phase Restoration areas, 48 Pressure Side Plate structural restorations against a trailing edge wall thickness rejection recorded on 48 of 48 airfoils, 48 vacuum furnace exposures across two mandatory solution heat treatment cycles, 655 mandatory inspection events, and a two material coating system rebuilt on fully restored substrates.

## 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 1,584 controlled operations on 24 MS6001FA 1st stage nozzle segments. 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 gas path   | 169                   | All 24 nozzle segments, 48 airfoils         |
| We rebuilt the structural weld and TPR areas        | 135                   | 87 weld areas, FPI before and after welding |
| We restored the structural wall and cooling system  | 168                   | 48 Pressure Side Plates made and fitted new |
| We cold straightened the nozzle segments to drawing | 48                    | Geometry corrected across the set           |
| We ran two solution heat treatment cycles           | 48                    | 48 vacuum furnace exposures                 |
| We inspected and held the set at 9 gates            | 630                   | 5 FPI and NDT control points                |
| We rebuilt the coating system                       | 72                    | On a fully restored substrate               |
| We received, assembled, documented and released     | 314                   | 478 detail parts fitted new                 |
| <b>TOTAL CONTROLLED OPERATIONS</b>                  | <b>1,584</b>          | <b>On 24 MS6001FA 1st stage nozzles</b>     |

The measurements that required this work: trailing edge wall below the 2.03 mm minimum on 48 of 48 airfoils, 87 weld areas gated by FPI, 96 TPR FPI events, and 478 of 478 detail parts 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 and full chemical strip               | 72                               | 254                  | 3.5 times (+253%)        |
| 2. Straightening and distortion correction        | 36                               | 132                  | 3.7 times (+267%)        |
| 3. Welding (GTAW) and Transient Phase Restoration | 84                               | 511                  | 6.1 times (+508%)        |
| 4. Heat treatment (vacuum solution)               | 0                                | 158                  | Not performed at Medium  |
| 5. Trailing edge restoration and cooling recovery | 62                               | 614                  | 9.9 times (+890%)        |
| 6. Hardware replacement and fit up                | 72                               | 110                  | 1.5 times (+53%)         |
| 7. Coating rebuild (HVOF MCrAlY and full TBC)     | 70                               | 306                  | 4.4 times (+337%)        |
| <b>TOTAL FOR THE SET, 24 SEGMENTS</b>             | <b>396</b>                       | <b>2,085</b>         | <b>5.3 times (+427%)</b> |

A Standard or Medium repair on this set of 24 MS6001FA 1st stage nozzle segments is 396 working hours. The **HEAVY REPAIR** we performed is 2,085 working hours. That is 5.3 times more work, 427 percent more. These are the same hours shown on invoice WO-1003946086 / WO-1003986864.

Reviewed and approved  
UNEW Engineering



**Paul McGuire**  
Engineering Manager