

FINAL INSPECTION REPORT & CERTIFICATE OF CONFORMANCE

UNEW's capital part refurbishment operations are governed by proprietary engineering technologies, precision standards, and rigorous QA/QC procedures developed for aviationgrade manufacturing. While refurbishment work is normally conducted at UNEW's U.S. facility, certain components from restricted regions are not eligible for import under U.S. national security and export control regulations.

To maintain uninterrupted service and consistent product quality, UNEW has partnered with EthosEnergy (United Kingdom)—a world-class turbine repair and overhaul organization operating one of the most advanced facilities in the industry. The EthosEnergy shop is equipped with fully automated precision systems, vacuum furnaces, electron beam welders, and advanced HVOF/TBC coating cells. Its quality system is certified to ISO 9001:2015, ISO 14001:2015, ISO 45001:2018, and ISO 17025:2017, ensuring full traceability, environmental stewardship, and occupational safety compliance.

All repair activities performed at EthosEnergy strictly follow UNEW's proprietary refurbishment procedures, material specifications, and inspection standards. The physical repair processes are executed by EthosEnergy, while UNEW retains full technical authority over repair methodology, metallurgical control, quality benchmarks, and final acceptance. This partnership guarantees that every refurbished component meets UNEW's aviationgrade quality and reliability standards for power generation service.

Customer Name: Nghi Son Refinery & Petrochemical, LLC.

Component type: MS6001FA 3rd STAGE SHROUD BLOCK

Report date: 30 October, 2025

Responsible Product Engineer: _____


Mr. Chaowarit Junjorhor
(Sr. Engineer)

Report prepared by: _____


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Report reviewed and approved by: _____


Mr. Pheerayawat Muadna
(Engineering Manager)

FINAL INSPECTION REPORT
1. INTRODUCTION

24 pcs. of MS6001FA 3rd stage Shroud block have been fully refurbished based on the requirements of the incoming inspection report findings.

Order Information	
EE Work Order no.	824033
Date of report	30 September 2025
Customer P.O. no.	PO04102025-HGP
Component Details	
Engine type	MS6001FA
Componee	3 rd stage Shroud block
Component part number	117E5970P004 REV H, 117E5970P005 REV H
Qty. received	24
Material type	SS304
As received coating type (s)	No
As received seal applied	Honeycomb seals
Additional items received with main set (if any)	-
Customer supplied component history	
Total fired hours	24,000
Total starts	(No information supplied)
Total factor fired hours	(No information supplied)
# 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)
Maintenance Intervals Combustion	(No information supplied)
Maintenance 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)	No

Work Order: 824033	MS6001FA 3rd STAGE SHROUD BLOCK
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2. INSPECTION SUMMARY

Following completion of the repair scope for the Stage 3 Shroud components, a final inspection was performed on September 30, 2025. All repair activities were executed in accordance with UNEW's proprietary engineering standards, including special coating requirements, defined repair categories, and the QA/QC procedures described in UNEW's Technical Brochure ID . The completed components were inspected against the applicable acceptance criteria and found to meet all required quality standards.

REPAIR LEVEL REQUIREMENT			
Descriptions		Qty	Unit
Inspection	Incoming inspection	1	Set
Repair level	Medium Repair and replace honeycomb	1	Set
Required	Replace Honeycomb seal (EETH4067-02)	24	Pc/set
Required	Medium repair entire set	1	set
Optional,	Weld plug pin of old down holes, Need to weld if this set of shrouds is not to use the same turbine. Need to drill the holes during the inspection. Strongly recommend using this HGP set with the same turbine as it with previously.	1	p/set

3. ENGINEERING REPAIR SUMMARY

All MS6001FA 3rd Stage Shroud Blocks were inspected, repaired, and certified in accordance with UNEW Proprietary Engineering Standards and the approved EthosEnergy Work Scope of Repair. Each component was confirmed to be within the medium repair limits, suitable for complete refurbishment and return to service.

Comprehensive incoming inspections were performed, including metallurgical evaluation, dimensional verification using a 3-piece fixture, and full-surface fluorescent penetrant inspection (FPI). The parts exhibited oxidation, honeycomb wear, and localized cracking typical of high-temperature exposure in long-term operation. All findings were documented, and the repair scope was confirmed with UNEW prior to commencement.

Repairs began with removal of worn honeycomb sections and cleaning of pressure-face surfaces. Affected areas were mechanically blended to eliminate oxidation and prepare for welding. Cracked and eroded zones were GTAW weld-restored using matching alloy filler under controlled inter-pass temperature. Following welding, all surfaces were blended, re-profiled, and dimensionally inspected in the assembly fixture to ensure correct arc curvature and sealing geometry.

Post-weld vacuum heat treatment was performed to relieve stress and stabilize the alloy microstructure. Repaired areas were verified by FPI and visual inspection to ensure complete structural soundness. New honeycomb material was precision-fitted and vacuum-brazed to the pressure-face surface, then blended flush with adjacent walls. Final dimensional and visual inspections confirmed conformity to drawing requirements and consistent honeycomb bonding.

Thermocouple guides were replaced where necessary and verified for correct alignment. Shot-peening and abrasive cleaning were performed to complete surface finishing and improve fatigue resistance.

All operations were executed under UNEW technical supervision and EthosEnergy's ISO 9001:2015, ISO 14001:2015, ISO 45001:2018, and ISO 17025:2017 certified quality management systems.

Final inspections confirmed complete compliance with engineering, metallurgical, and dimensional specifications. The refurbished 3rd Stage Shroud Blocks are therefore certified serviceable for reinstallation at Nghi Son Refinery & Petrochemical.

FINAL INSPECTION REPORT**4. CERTIFICATE OF CONFORMANCE****Component:** MS6001FA 3rd Stage Shroud Block Assembly**Quantity:** (Insert Quantity)**Material:** Haynes 188 / Nimonic Alloy**Repair Category:** Medium Repair**Work Order No.:** (Insert Number)**Customer:** Nghi Son Refinery & Petrochemical LLC**Repair Facility:** EthosEnergy (Thailand) Ltd.**Technical Authority:** UNEW, Inc. (USA)

EthosEnergy (Thailand) Ltd., operating under the technical authorization of UNEW, Inc., hereby certifies that all MS6001FA 3rd Stage Shroud Blocks identified above have been inspected, repaired, heat-treated, and brazed in full compliance with the approved Work Scope of Repair and UNEW Proprietary Engineering Standards.

The medium-repair program included:

- Full incoming inspection (dimensional, FPI, metallurgical, and assembly fixture verification).
- Removal of thermocouple guides, oxidation, and honeycomb sections from pressure-face surfaces.
- Localized GTAW weld repair of cracks, oxidation loss, and base metal thinning.
- Vacuum post-weld heat treatment and FPI re-inspection for metallurgical integrity.
- Installation of new precision-formed honeycombs, followed by vacuum brazing and contour blending to match original shroud profiles.
- Dimensional inspection in 3-piece fixture to ensure curvature and fit conformity.
- Replacement of thermocouple guides where required and final visual inspection confirming complete compliance.

All work was conducted under ISO 9001:2015, ISO 14001:2015, ISO 45001:2018, and ISO 17025:2017 certified quality systems.

Final inspections and quality records verify that all refurbished components conform to engineering, metallurgical, and dimensional specifications.

Accordingly, EthosEnergy (Thailand) Ltd. and UNEW, Inc. jointly certify that the above components have met all contractual and technical requirements and are hereby released in serviceable condition for reinstallation at Nghi Son Refinery & Petrochemical.

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FINAL INSPECTION REPORT
5. COMPONENT CORRELATION:

CORRELATION SHEET			
Item	Part number	Serial number	Material
1	117E5970P005 REV H	16167-1	SS304
2	117E5970P004 REV H	16167-2	SS304
3	117E5970P004 REV H	16167-3	SS304
4	117E5970P004 REV H	16167-4	SS304
5	117E5970P004 REV H	16167-5	SS304
6	117E5970P004 REV H	16167-6	SS304
7	117E5970P005 REV H	16167-7	SS304
8	117E5970P004 REV H	16167-8	SS304
9	117E5970P004 REV H	16167-9	SS304
10	117E5970P004 REV H	16167-10	SS304
11	117E5970P005 REV H	16167-11	SS304
12	117E5970P004 REV H	16167-12	SS304
13	117E5970P004 REV H	16167-13	SS304
14	117E5970P004 REV H	16167-14	SS304
15	117E5970P004 REV H	16167-15	SS304
16	117E5970P004 REV H	16167-16	SS304
17	117E5970P004 REV H	16167-17	SS304
18	117E5970P004 REV H	16167-18	SS304
19	117E5970P004 REV H	16167-19	SS304
20	117E5970P004 REV H	16167-20	SS304
21	117E5970P004 REV H	16167-21	SS304
22	117E5970P004 REV H	16167-22	SS304
23	117E5970P004 REV H	16157-21	SS304
24	117E5970P004 REV H	16157-22	SS304

6. SCOPE OF WORK:

Work scope	Inspect	Medium
Inspect		
Perform receipt inspection and record serial numbers	X	
Perform metallurgical evaluation of base material, report on condition	X	
Abrasive blast to clean all surfaces	X	
Performing incoming solution heat treatment in partial pressure vacuum environment	X	
Set in 3-pcs assembly fixture and perform dimensional inspection	X	
Perform fluorescent penetrant inspection	X	
Compile incoming inspection report and forward to customer	X	
Repair		
Remove thermocouple guide as required		X
MC / Blend to remove honeycomb section		X
Blend to remove oxidation product on external repairable areas		X
Prepare areas for weld repair as required		X
Perform weld repairs as required		X
Blend all repaired areas to restore component profile		X
Set in 3-pcs assembly fixture and perform dimensional inspection		X
Perform fluorescent penetrant inspection		X
Perform post repair treatment based on material specifications		X
Perform fluorescent penetrant inspection		X
Prepare and fit replacement honeycombs to pressure face surfaces		X
Perform braze heat treatment		X

Perform visual inspection		X
Blend excess honeycomb section flush with shroud block side walls		X
Abrasive blast to clean all surfaces (if required)		X
Set in 3-pcs assembly fixture and perform dimensional inspection		X
Replace thermocouple guide as required		X
Perform final visual inspection		X
Compile final report, pack and ship components with all required documentation as listed on the purchase order		X

Performed:

- Replace new honeycombs (standard work scope).

FINAL INSPECTION REPORT
7.0. ENGINEERING DETAIL WORK DONE
7.1. Inspection Phase

Task	Detailed Description
Perform receipt inspection and record serial numbers	Each 3rd Stage Shroud Block was received, logged by serial number, and visually inspected to confirm quantity and packaging condition. Any signs of shipping damage or distortion were recorded and photographed.
Perform metallurgical evaluation of base material, report on condition	Representative sections of the shroud were analyzed to verify alloy composition, microstructure condition, and extent of service oxidation. Results confirmed that the base material remained within repairable metallurgical limits.
Abrasive blast to clean all surfaces	Surfaces were grit-blasted using calibrated pressure and media to remove oxides, corrosion, and coating residues while preserving dimensional accuracy and base metal integrity.
Perform incoming solution heat treatment in partial pressure vacuum environment	A controlled vacuum/partial-pressure solution heat treatment was applied to restore the base-metal microstructure and reduce residual stress prior to repair.
Set in 3-pcs assembly fixture and perform dimensional inspection	The three-piece shroud segment was assembled into a precision fixture to measure dimensional parameters such as arc curvature, height, and mating alignment against nominal values.
Perform fluorescent penetrant inspection (FPI)	FPI was performed on the complete surface area to detect cracks, porosity, and service-induced degradation. Indications were marked and recorded for repair planning.
Compile incoming inspection report and forward to customer	A comprehensive report—including dimensional data, photographs, and FPI mapping—was compiled and submitted to UNEW for review and repair authorization.

7.2. Repair Phase

Task	Detailed Description
Remove thermocouple guide as required	Damaged or eroded thermocouple guides were removed to allow full access for cleaning, inspection, and repair in adjacent areas. Guides were retained for potential reinstallation or replacement.
MC / Blend to remove honeycomb section	The existing worn honeycomb material on the pressure-face sealing surface was mechanically cut

FINAL INSPECTION REPORT

Task	Detailed Description
	(machine-cut) and blended off to expose a clean, bond-ready substrate.
Blend to remove oxidation product on external repairable areas	Oxidation layers, corrosion, and deposits were mechanically blended away to achieve a uniform metal surface suitable for welding or brazing.
Prepare areas for weld repair as required	Cracked, thinned, or eroded sections of the base metal were ground and machined to sound material with defined weld-prep geometry per engineering instruction.
Perform weld repairs as required	Localized cracks and material loss were restored using GTAW welding with compatible filler alloy. Heat input and inter-pass temperature were controlled to maintain microstructural integrity.
Blend all repaired areas to restore component profile	Post-weld blending restored the repaired surfaces to nominal contour and smoothness, ensuring uniform gas-path flow characteristics.
Set in 3-pcs assembly fixture and perform dimensional inspection	The shroud blocks were reassembled in the 3-piece fixture for dimensional verification of restored geometry and correct alignment after welding.
Perform fluorescent penetrant inspection	FPI was performed to confirm that all repaired welds were free from surface-connected defects such as porosity, cracks, or lack of fusion.
Perform post-repair treatment based on material specifications	Heat treatment was conducted per alloy specification (e.g., Haynes 188) to relieve weld stress and stabilize microstructure following repair.
Perform fluorescent penetrant inspection	A second FPI verified that no heat-induced cracking or metallurgical changes occurred during post-repair treatment.
Prepare and fit replacement honeycombs to pressure-face surfaces	New honeycomb material was precision-cut, pre-formed, and tack-welded to the pressure-face areas for sealing restoration. Honeycombs matched OEM cell size and thickness.
Perform braze heat treatment	Vacuum brazing bonded the honeycomb to the base metal using high-temperature Ni-based braze alloy, achieving full metallurgical adhesion.

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Task	Detailed Description
Perform visual inspection	Engineers inspected braze fillets, honeycomb integrity, and joint continuity to confirm complete bonding and absence of voids or unfilled regions.
Blend excess honeycomb section flush with shroud block side walls	Excess honeycomb material was carefully blended and machined flush with shroud side walls to ensure smooth gas-path transitions and assembly fit.
Abrasive blast to clean all surfaces (if required)	A light abrasive blast was performed to remove oxidation from brazed areas and prepare the surface for final inspection.
Set in 3-pcs assembly fixture and perform dimensional inspection	A final dimensional inspection in the 3-piece fixture verified correct curvature, fit, and overall assembly geometry prior to reinstallation.
Replace thermocouple guide as required	New thermocouple guides were fitted and welded in place where previously removed. Final alignment and fit were confirmed per design specifications.
Perform final visual inspection	A comprehensive visual inspection under magnification confirmed repair quality, weld integrity, and surface finish. All parts were approved for final documentation.
Compile final report, pack and ship components with all required documentation as listed on the purchase order	A detailed Final Inspection Report—including FPI charts, heat-treatment records, dimensional inspection data, and photographs—was compiled. Components were cleaned, protected, labeled, and packed for shipment to NSRP.
Replace new honeycombs (standard work scope)	In accordance with standard repair practice, all honeycombs were replaced with new material of the same alloy type, thickness, and cell geometry to ensure reliable sealing and durability.

Result

All MS6001FA 3rd Stage Shroud Blocks were refurbished under UNEW Proprietary Engineering Procedures and EthosEnergy ISO-certified QA/QC standards. The completed medium-repair scope restored structural integrity, dimensional accuracy, and sealing performance equivalent to OEM standards. All components successfully passed dimensional, NDT, and visual inspections and are certified serviceable for reinstallation at Nghi Son Refinery & Petrochemical.

8. PHOTOGRAPHS:



Fig.1 Final inspection.



Fig.2 Final inspection.



Fig.3 Final inspection.



Fig.4 Final inspection.

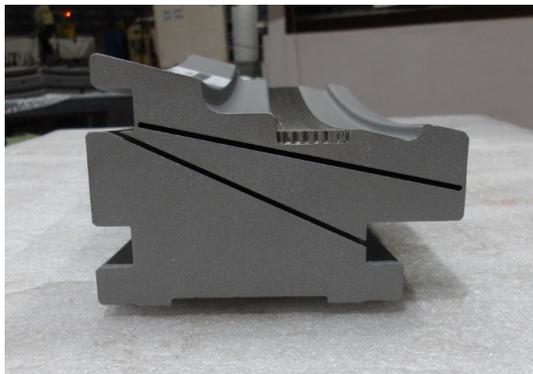
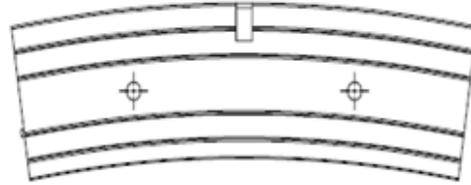


Fig.5 Final inspection. .

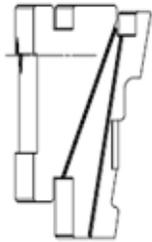


Fig.6 Fixture inspection.

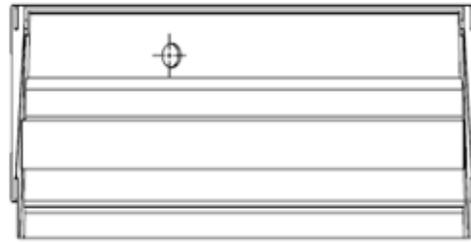
9. DEFECT LEGEND TABLE:



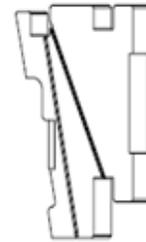
FWD SIDE



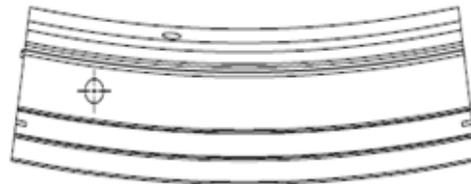
LEFT SIDE



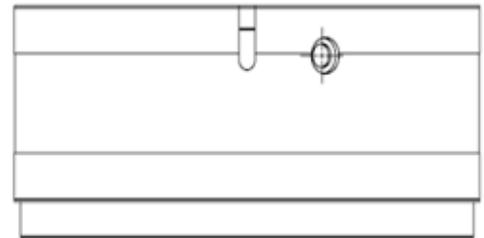
PRESSURE FACE



RIGHT SIDE



AFT SIDE



BACK SIDE

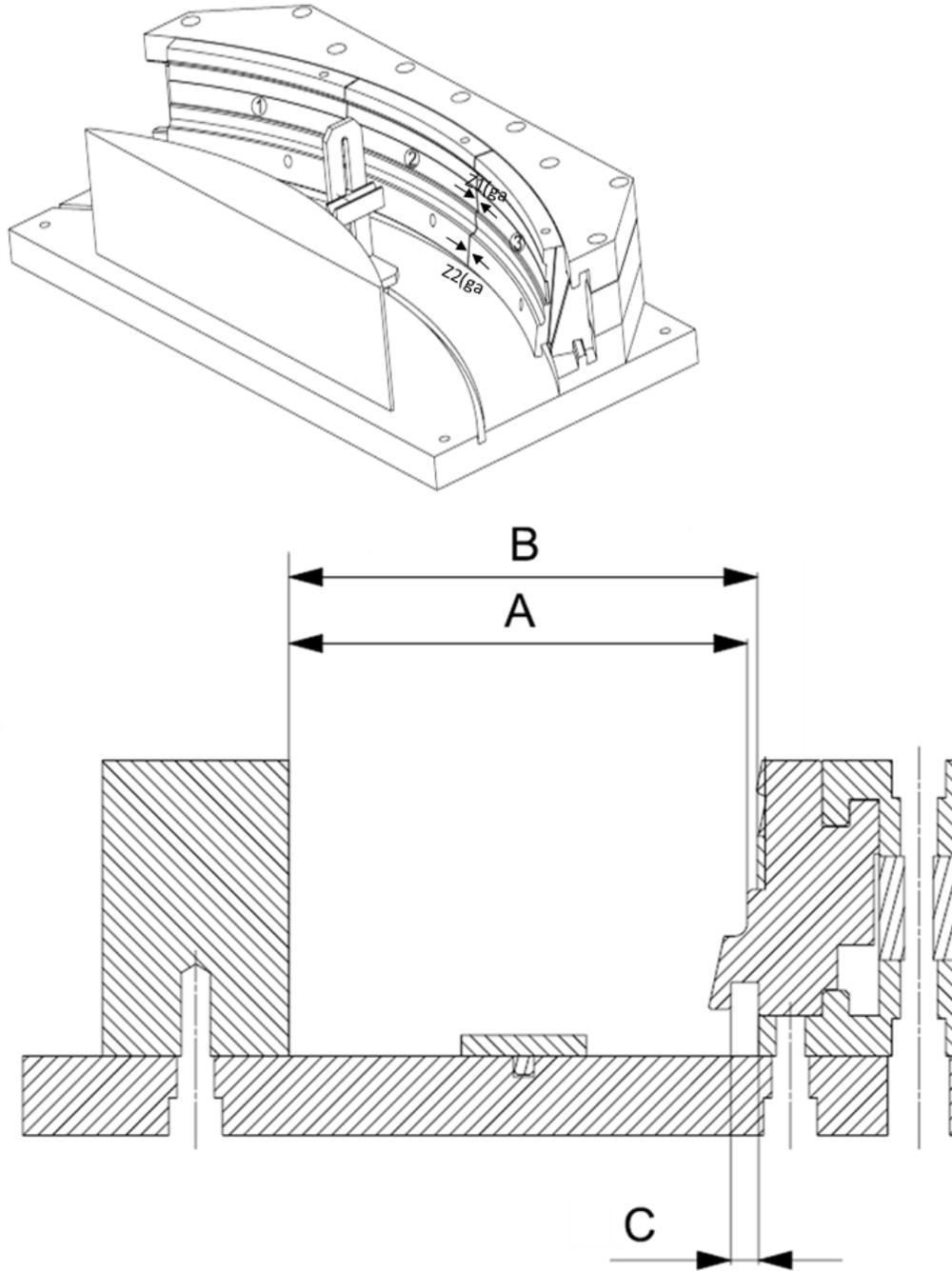
FINAL INSPECTION REPORT

2st stg Shroud block No.	INSPECTION FINDINGS																	INSPECTION FINDINGS						
	Pressure face				Left/Right side					Forward side				Aftward side				Back side			Honey comb			
	Cracking	Corrosion	Wear	FOD	Cracking	Corrosion	Wear	FOD	Missing material	Corrosion	Wear	FOD	Cracking	Corrosion	Wear	FOD	Cracking	Cracking	Wear	FOD	Cracking	Wear	FOD	Deformation
1				B				B			B/WB				B	B							R	
2				B/WB				B/WB			B/WB				B	B							R	
3				B				B/WB			B/WB				B	B/WB							R	
4				B/WB				B/WB			B/WB				B	B/WB							R	
5				B/WB				B/WB			B/WB				B	B							R	
6				B				B/WB			B/WB				B	B/WB							R	
7				B/WB				B/WB			B/WB				B	B							R	
8				B				B/WB			B/WB				B	B							R	
9				B/WB				B/WB			B/WB				B	B							R	
10				B/WB				B/WB			B/WB				B	B							R	
11				B				B/WB			B/WB				B	B							R	
12				B				B			B/WB				B	B							R	
13				B				B/WB			B/WB				B	B/WB							R	
14				B/WB				B/WB			B/WB				B	B/WB							R	
15				B/WB				B/WB			B/WB				B	B							R	
16				B/WB				B/WB			B/WB				B	B							R	
17				B/WB				B/WB			B/WB				B	B/WB							R	
18				B/WB				B/WB			B/WB				B	B							R	
19				B/WB				B/WB			B/WB				B	B/WB							R	
20				B				B/WB			B/WB				B	B							R	
21				B/WB				B/WB			B/WB				B	B/WB							R	
22				B/WB				B/WB			B/WB				B	B/WB							R	
23				B/WB				B/WB			B/WB				B	B							R	
24				B				B			B/WB				B	B							R	

WE - Welding and Electric discharge machining (EDM) to be performed to build material dimensions and restore original dimensions .
 T PR - Transient Phase Restoration to be performed based on the defects detected.
 R - Replace with new.
 A CC - Acceptable as is.
 Rej - Dimension unacceptable and will require repair or cause of scrap.
 S - Non-repairable / Scrap
 L - Light repair category
 M - Medium repair category
 H - Heavy repair category
 EX -Salvation repair category

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10. DIMENSION INSPECTION: (Fixture inspection)



Dimension Inspection							
ITEM	POSITION (Unit : mm.)						Result
	A	B	C	G1(gap)	G1(gap)	Bore scope hole ID	
1	221.35	226.92	13.06	ACC	ACC	13.03	ACC
2	221.37	226.91	13.00	ACC	ACC	-	ACC
3	221.32	226.92	13.04	ACC	ACC	-	ACC
4	221.39	226.91	13.03	ACC	ACC	-	ACC
5	221.36	226.80	12.99	ACC	ACC	-	ACC
6	221.33	226.79	13.04	ACC	ACC	-	ACC
7	221.35	226.82	13.02	ACC	ACC	12.97	ACC
8	221.41	226.95	13.08	ACC	ACC	-	ACC
9	221.39	226.77	13.07	ACC	ACC	-	ACC
10	221.39	226.92	12.99	ACC	ACC	-	ACC
11	221.34	226.84	13.01	ACC	ACC	12.88	ACC
12	221.33	226.87	13.08	ACC	ACC	-	ACC
13	221.37	226.94	13.04	ACC	ACC	-	ACC
14	221.35	226.87	13.04	ACC	ACC	-	ACC
15	221.34	226.78	12.98	ACC	ACC	-	ACC
16	221.42	226.90	13.02	ACC	ACC	-	ACC
17	221.40	226.97	13.02	ACC	ACC	-	ACC
18	221.34	226.87	13.09	ACC	ACC	-	ACC
19	221.43	226.77	13.04	ACC	ACC	-	ACC
20	221.41	226.80	13.07	ACC	ACC	-	ACC
21	221.39	226.85	13.03	ACC	ACC	-	ACC
22	221.33	226.87	13.05	ACC	ACC	-	ACC
23	221.32	226.87	13.06	ACC	ACC	-	ACC
24	221.35	226.94	13.05	ACC	ACC	-	ACC

FINAL INSPECTION REPORT

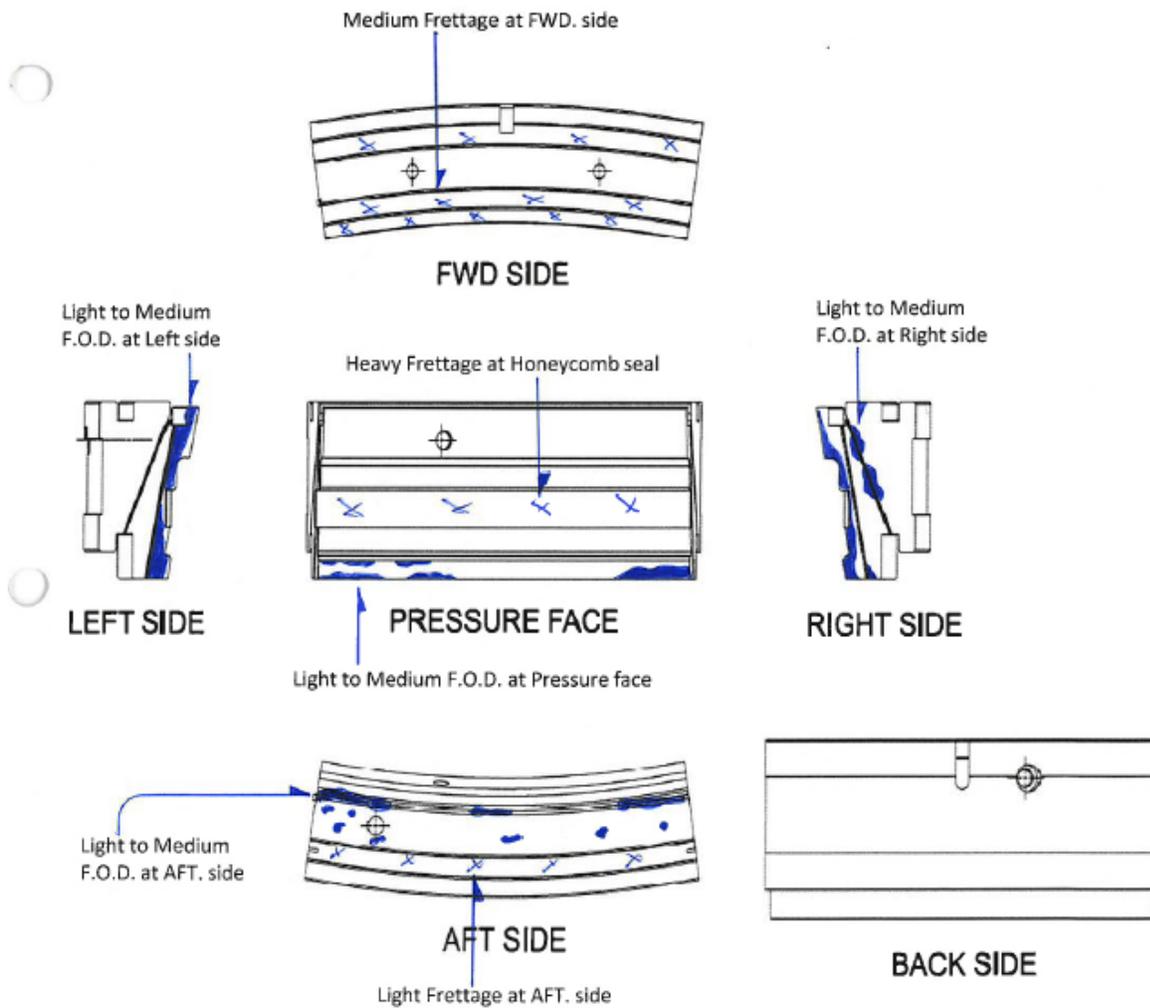
11. DEFECT MAP:

INSPECTION AND PROCESS RECORD SHEET	MS6001FA STAGE 3 SHROUD BLOCK	IPRS NO.	3070-40
	PART NUMBER : GESB03M6FA	REV.	01
CUSTOMER :	Nghi Son Refinery	CUSTOMER PO :	
JOB NUMBER :	824033	OP.	0080
INSPECTED BY :	Rewat / Methee	DATE :	01/07/2025

Mapping of FPI and Visual Inspection

- Crack (mm)
- Foreign Object Damage (L/M/H)
- Fretting (L/M/H)
- Deformation area(mm²)
- Corrosion (L/M/H)
- Missing Material (mm²)

(Incoming condition)



TYPICAL DEFECT

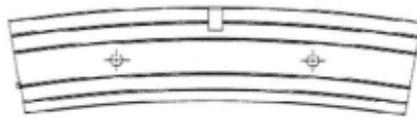
Unit: mm

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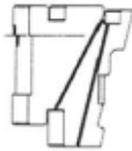
FINAL INSPECTION REPORT

INSPECTION AND PROCESS RECORD SHEET	MS6001FA STAGE 3 SHROUD BLOCK	IPRS NO.	3070-40
	PART NUMBER : GESB03M6FA	REV.	01
CUSTOMER :	Nghi Son Refinery &	CUSTOMER PO :	PO04102025-HGP
JOB NUMBER :	824033-1	OP.	Final
INSPECTED BY :	Kriangkrai.	DATE :	25/09/2025
Mapping of FPI and Visual Inspection			

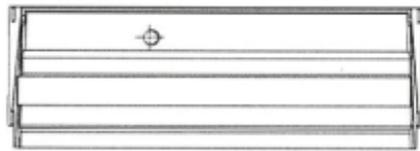
Crack (mm)
 Foreign Object Damage (L/MM)
 Fretting (L/MM)
 Deformative area(mm²)
 Corrosion (L/MM)
 Missing Material (mm²)



FWD SIDE



LEFT SIDE



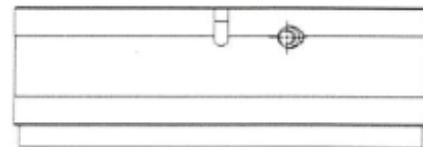
PRESSURE FACE



RIGHT SIDE



AFT SIDE



BACK SIDE