

TECHNICAL CHARACTERISTICS ANALYSIS AND COMPARISON OFFERED CAPITAL PARTS VERSUS THE REQUIREMENTS OF THE BIDDING DOCUMENTS

Materials, operating conditions and working environment. Demonstration of equivalence and compatibility for installation in the Siemens SGT5-2000E / V94.2 (Si3D) gas turbine unit, Phú Mỹ 2.1 Ext. Thermal Power Plant

Document No.: UNEW-GENCO3-PM21-TEC-001, Rev. 01

Bid: Supply of capital and major spare parts for the Phú Mỹ 2.1 Ext. Thermal Power Plant, Phú Mỹ Thermal Power Company, EVNGENCO3

Scope: All 55 offered line items, comprising 12 turbine vane segment items, 11 turbine blade items and 32 compressor blade items

Date: 10 August 2026

1. Purpose

The Bidding Documents require the Bidder to provide an analysis and comparison table of the technical characteristics of the offered parts against the Bidding Documents, including the materials, the operating conditions and the working environment, in order to demonstrate that the offered goods are equivalent to and compatible for installation in the V94.2 (Si3D) gas turbine unit. This document is issued in response to that requirement and covers every one of the 55 offered items, without exception and without deviation.

Each item is compared individually in Section 7 against the requirement for its position in the machine, the operating condition of that position and the working environment of the site. The materials are analysed in Sections 8 and 9, the operating conditions in Section 10, the working environment in Section 12, the interchangeability in Section 13 and the verification records in Section 15.

2. Reference Documents

This analysis is supported by the following documents. All three UNEW documents are the property of UNEW, Inc. UNEW-PL-001 is submitted with this Bid. UNEW-CAT-001 and UNEW-MATL-001 are available for verification by the Owner at any time.

Document number and revision	Title	Content used in this analysis
UNEW-CAT-001, Rev. 00, 2026	UNEW General Product Catalogue, Gas Turbine Capital Parts	Position, function, base material, strengthening, coating, cooling, firing temperature capability, root and fixing, sealing, manufacturing route, inspection scope and reference chemistry for every offered item
UNEW-MATL-001, Rev. 00, 2026	UNEW Material Composition Schedule, Turbine and Compressor Blading	Nominal chemical composition of every material grade offered, material standards, material numbers, maximum service temperatures and stage allocation
UNEW-PL-001, Rev. 00, 2026	UNEW Part List with installation location on the machine	Part numbers, PB numbers, drawing item location numbers, installation location on the machine and description for every offered item
Bidding Documents issued by EVNGENCO3	Phú Mỹ 2.1 Ext. Thermal Power Plant, supply of capital and major spare parts	Required parts, quantities, installation positions and technical requirements against which the offered items are compared



3. Basis of the Evaluation and Design Ownership

UNEW, Inc. is the designer and manufacturer of every item offered under this Bid. UNEW holds the complete technical record for each item, comprising the governing drawings, the part numbering, the drawing item location numbering, the material specification, the reference chemistry, the coating specification, the manufacturing route and the inspection criteria. Every technical value stated in this analysis is taken from UNEW documentation listed in Section 2 and can be produced for verification by the Owner at any time.

The comparison in this document is therefore a comparison between the requirement stated by the Owner for each position in the machine and the technical record held by the manufacturer of the part offered for that position. It is not an assessment made from published or general data. Part numbers, PB numbers and drawing item location numbers shown throughout are UNEW numbers assigned by UNEW, Inc. as the manufacturer, and are not Siemens original equipment manufacturer numbers.

Because UNEW holds the design, the supply of these parts, the supply of repeat orders and the continuity of spares over the life of the plant do not depend on any third party document, licence or release. The Owner deals directly with the organization that designs the part, manufactures it, inspects it, releases it and, where required, installs and services it in the machine.

The chemical compositions quoted in this analysis and in document UNEW-MATL-001 are the nominal compositions of the stated grades. The parts actually supplied are released with the applicable mill, casting and laboratory certificates, dimensional records, non destructive testing results and coating records for the specific heat and lot, and those certificates are the governing record of the delivered chemistry.

4. Machine and Site Data Used as the Basis of the Comparison

A part is equivalent only if it is capable at the position in which it operates and in the environment in which the machine runs. The comparison is therefore made against the following machine and site data.

Plant	Phú Mỹ 2.1 Ext. Thermal Power Plant, Phú Mỹ Thermal Power Company
Location	Phú Mỹ 1 Industrial Zone, Phú Mỹ town, Ho Chi Minh City, Viet Nam
Gas turbine	Siemens SGT5-2000E / V94.2 (Si3D), single shaft, 50 Hz
Rated speed	3,000 rpm
Compressor	16 rotating stages with variable inlet guide vane row
Turbine	4 rotating blade rows and 4 stationary vane rows
Combustion system	Two external silo type combustion chambers with ceramic tile lining and hybrid burners
Fuel	Natural gas as primary fuel, distillate as back up fuel
Firing temperature, engine class	Up to approximately 1,060 degrees C at base load
Compressor discharge pressure	Approximately 11 bar at base load
Compressor discharge temperature	Approximately 360 degrees C at base load
Turbine exhaust temperature	Approximately 540 degrees C at base load
Site climate	Tropical coastal, high ambient humidity throughout the year, salt bearing marine air, mean ambient temperature of the order of 27 degrees C
Duty	Base load and mid merit operation with daily and weekly start and stop cycles

5. Comparison Methodology and Criteria

Equivalence has been assessed against eight criteria. For each criterion the table states what is compared and how the comparison is verified. No criterion is asserted without a corresponding verification record, and the records are listed in Section 15.

Criterion	Characteristic compared	Method of verification
Form	Airfoil profile, platform and shroud geometry, root form, overall dimensions and mass	Manufactured to the UNEW governing drawing. First article dimensional inspection and coordinate measuring machine report issued for each part type
Fit	Root and groove engagement, carrier and slot engagement, seal groove dimensions, assembly clearances	Root form and mating dimensions verified by gauge and coordinate measurement. Trial fit performed where the drawing requires it
Function	Throat area, cooling configuration, moment weight class, natural frequency, aerodynamic performance	Throat area measured and recorded for every vane segment. Moment weight measured and classified for every rotating blade. Frequency check on rotating blades where specified
Material	Base material grade, chemical composition, mechanical properties, heat treatment condition	Material certified to EN 10204 type 3.1 or 3.2. Chemical composition verified at the UNEW ISO/IEC 17025 accredited laboratory
Coating and surface protection	Bond coat and thermal barrier coating type, thickness, adhesion and microstructure, internal diffusion coating, surface finish and peening	Coating applied under Nadcap accredited special process control. Thickness, adhesion and metallographic examination recorded for each batch
Operating condition suitability	Capability of the material and coating system at the temperature, pressure and stress of the installed position	Assessed position by position in Section 7 and analysed against material capability in Section 8
Working environment suitability	Resistance to the fuel condition, the intake air quality and the site climate	Assessed in Section 12
Interchangeability	Direct installation in the unit without modification of the machine or of any adjacent part	Confirmed for every item in Section 7 and evidenced by the records listed in Section 13

6. General Technical Equivalence Summary

The table below summarizes the result of the comparison by component group. The detailed item by item comparison for all 55 items follows in Section 7.

Component group	Material offered	Coating, cooling or finish	Operating condition and environment	Basis of equivalence	Result
Turbine vanes, rows 1 to 4 (items 1 to 12)	FSX-414 cobalt base cast superalloy, solid solution strengthened	MCrAlY overlay where specified by drawing. Film and convection cooled rows 1 and 2, reduced cooling row 3, uncooled row 4	Stationary hot gas path duty, gas temperature up to approximately 1,060 degrees C at row 1, thermal cycling, oxidation and hot corrosion	Same vane row and carrier position, same standard, joint and instrumented functions, throat area and platform geometry to the governing drawing	Equivalent and compatible
Turbine blades, rows 1 to 4 (items 13 to 23)	IN738LC nickel base cast superalloy, gamma prime strengthened	Row 1 MCrAlY bond coat with YSZ thermal barrier coating, row 2 MCrAlY overlay, rows 3 and 4 per drawing. Internal aluminide diffusion coating on cooled surfaces	Rotating hot gas path duty at 3,000 rpm, gas temperature up to approximately 1,060 degrees C at row 1, creep, thermal and mechanical fatigue	Same wheel row, same fir tree root, same standard, locking and weighted functions, moment weight class controlled	Equivalent and compatible
Compressor blades, stages 1 to 4 (items 24 to 31)	Ti-6Al-4V (Grade 5), ASTM B348 / AMS 4928	Controlled finish airfoil, shot peened	Front and transonic compressor stages, air up to approximately 120 degrees C, material capability approximately 315 degrees C, humid and salt bearing intake air	Same stage, same dovetail root, same standard and locking configuration	Equivalent and compatible
Compressor blades, stages 5 to 10 (items 32 to 43)	X20Cr13 (1.4021), EN 10088-3	Hardened and tempered, controlled finish	Mid compressor stages, air approximately 120 to 260 degrees C, material capability approximately 400 degrees C, corrosion from carry over of salt and moisture	Same stage, same dovetail root, same standard and locking configuration	Equivalent and compatible
Compressor blades, stages 11 to 16 (items 44 to 55)	X22CrMoV12-1 (1.4923), EN 10302	Hardened and tempered, controlled finish	Rear compressor stages, air approximately 260 to 360 degrees C at up to 11.1 bar, material capability approximately 580 degrees C	Same stage, same dovetail root, same standard and locking configuration	Equivalent and compatible

7. Detailed Item by Item Analysis and Comparison, All 55 Offered Items

Each line item is compared against the required machine position and duty. The conclusion Equivalent and Compatible means that the offered item is assigned to the same machine location and function as the required item, is manufactured in the material class and to the geometry required for that location, carries the coating or surface protection required for the duty, has a material capability that exceeds the service condition of the position, and installs directly in the unit without modification of the machine or of any adjacent part.

7.1 Turbine Vane Segments, Items 1 to 12

No.	Item identification	Requirement per the Bidding Documents and installation duty	Characteristics of the item offered by UNEW, Inc.	Operating conditions and working environment at the installed position	Manufacturing, inspection and interface control	Analysis and conclusion
1	Part No.: A2A50021940-G001 PB No.: PB0000251001 Drawing item: MBCSN10.0101 Composition ref.: A2A-TV01-001	Standard Turbine Vane Segment, Row 1. Installation: Installed on the turbine stator carrier (vane carrier), turbine vane row 1, upper and lower halves, drawing "Turbine Stator", Item No.: MBCSN10.0101. Required duty: direct replacement stationary vane segment for turbine row 1, with correct airfoil, platform, carrier fit, sealing and cooling interfaces, and throat area within the drawing band.	Material: FSX-414 cobalt base superalloy, vacuum investment cast, solid solution strengthened. Nominal 29.5 Cr, 10.5 Ni, 7.0 W, 0.25 C, balance Co. Coating: MCrAlY overlay per the governing drawing. Cooling: Film and convection cooled. Firing temperature capability: up to approximately 1,060 degrees C, engine class. Fixing: located and retained per the casing drawing. Sealing: seal wires and strips. Composition reference A2A-TV01-001.	Stationary first nozzle position. Gas temperature at inlet up to approximately 1,060 degrees C at base load, local peak higher. Metal temperature approximately 850 to 900 degrees C with film and convective cooling. Severe thermal cycling at every start and stop, oxidation, type I hot corrosion, particulate erosion.	Vacuum investment casting. FPI, radiographic testing of the casting, dimensional and coordinate measuring machine inspection, coating audit, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
2	Part No.: A2A50021941-G002 PB No.: PB0000251002 Drawing item: MBCSN90.0002 Composition ref.: A2A-TV01-001	Joint/Lead Vane Segment, Row 1. Installation: Installed on the turbine stator carrier (vane carrier), turbine vane row 1, upper and lower halves, drawing "Turbine Stator", Item No.: MBCSN90.0002. Required duty: direct replacement stationary vane segment for turbine row 1, with correct airfoil, platform, carrier fit, sealing and cooling interfaces, and throat area within the drawing band.	Material: FSX-414 cobalt base superalloy, vacuum investment cast, solid solution strengthened. Nominal 29.5 Cr, 10.5 Ni, 7.0 W, 0.25 C, balance Co. Coating: MCrAlY overlay per the governing drawing. Cooling: Film and convection cooled. Firing temperature capability: up to approximately 1,060 degrees C, engine class. Fixing: located and retained per the casing drawing. Sealing: seal wires and strips. Composition reference A2A-TV01-001.	Stationary first nozzle position. Gas temperature at inlet up to approximately 1,060 degrees C at base load, local peak higher. Metal temperature approximately 850 to 900 degrees C with film and convective cooling. Severe thermal cycling at every start and stop, oxidation, type I hot corrosion, particulate erosion.	Vacuum investment casting. FPI, radiographic testing of the casting, dimensional and coordinate measuring machine inspection, coating audit, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
3	Part No.: A2A50021942-G003 PB No.: PB0000251003 Drawing item: MBCSN90.0003 Composition ref.: A2A-TV01-001	Instrumented/Transition Vane Segment, Row 1. Installation: Installed on the turbine stator carrier (vane carrier), turbine vane row 1, upper and lower halves, drawing "Turbine Stator", Item No.: MBCSN90.0003. Required duty: direct replacement stationary vane segment for turbine row 1, with correct airfoil, platform, carrier fit, sealing and cooling interfaces, and throat area within the drawing band.	Material: FSX-414 cobalt base superalloy, vacuum investment cast, solid solution strengthened. Nominal 29.5 Cr, 10.5 Ni, 7.0 W, 0.25 C, balance Co. Coating: MCrAlY overlay per the governing drawing. Cooling: Film and convection cooled. Firing temperature capability: up to approximately 1,060 degrees C, engine class. Fixing: located and retained per the casing drawing. Sealing: seal wires and strips. Composition reference A2A-TV01-001.	Stationary first nozzle position. Gas temperature at inlet up to approximately 1,060 degrees C at base load, local peak higher. Metal temperature approximately 850 to 900 degrees C with film and convective cooling. Severe thermal cycling at every start and stop, oxidation, type I hot corrosion, particulate erosion.	Vacuum investment casting. FPI, radiographic testing of the casting, dimensional and coordinate measuring machine inspection, coating audit, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
4	Part No.: A2A50024312-G001 PB No.: PB0000251004 Drawing item: MBCSN10.0204 Composition ref.: A2A-TV02-001	Standard Turbine Vane Segment, Row 2. Installation: Installed on the turbine stator carrier (vane carrier), turbine vane row 2, upper and lower halves, drawing "Turbine Stator", Item No.: MBCSN10.0204. Required duty: direct replacement stationary vane segment for turbine row 2, with correct airfoil, platform, carrier fit, sealing and cooling interfaces, and throat area within the drawing band.	Material: FSX-414 cobalt base superalloy, vacuum investment cast, solid solution strengthened. Nominal 29.5 Cr, 10.5 Ni, 7.0 W, 0.25 C, balance Co. Coating: MCrAlY overlay per the governing drawing. Cooling: Film and convection cooled. Firing temperature capability: up to approximately 1,060 degrees C, engine class. Fixing: located and retained per the casing drawing. Sealing: seal wires and strips. Composition reference A2A-TV02-001.	Stationary second stage position. Gas temperature approximately 930 to 960 degrees C. Metal temperature approximately 780 to 830 degrees C with film and convective cooling. Thermal cycling, oxidation, hot corrosion, moderate erosion.	Vacuum investment casting. FPI, radiographic testing of the casting, dimensional and coordinate measuring machine inspection, coating audit, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE

No.	Item identification	Requirement per the Bidding Documents and installation duty	Characteristics of the item offered by UNEW, Inc.	Operating conditions and working environment at the installed position	Manufacturing, inspection and interface control	Analysis and conclusion
5	Part No.: A2A50024312-G002 PB No.: PB0000251005 Drawing item: MBCSN90.0005 Composition ref.: A2A-TV02-001	Joint Vane Segment, Row 2. Installation: Installed on the turbine stator carrier (vane carrier), turbine vane row 2, upper and lower halves, drawing "Turbine Stator", Item No.: MBCSN90.0005. Required duty: direct replacement stationary vane segment for turbine row 2, with correct airfoil, platform, carrier fit, sealing and cooling interfaces, and throat area within the drawing band.	Material: FSX-414 cobalt base superalloy, vacuum investment cast, solid solution strengthened. Nominal 29.5 Cr, 10.5 Ni, 7.0 W, 0.25 C, balance Co. Coating: MCrAlY overlay per the governing drawing. Cooling: Film and convection cooled. Firing temperature capability: up to approximately 1,060 degrees C, engine class. Fixing: located and retained per the casing drawing. Sealing: seal wires and strips. Composition reference A2A-TV02-001.	Stationary second stage position. Gas temperature approximately 930 to 960 degrees C. Metal temperature approximately 780 to 830 degrees C with film and convective cooling. Thermal cycling, oxidation, hot corrosion, moderate erosion.	Vacuum investment casting. FPI, radiographic testing of the casting, dimensional and coordinate measuring machine inspection, coating audit, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
6	Part No.: A2A50024312-G003 PB No.: PB0000251006 Drawing item: MBCSN10.0206 Composition ref.: A2A-TV02-001	Instrumented Turbine Vane Segment, Row 2. Installation: Installed on the turbine stator carrier (vane carrier), turbine vane row 2, upper and lower halves, drawing "Turbine Stator", Item No.: MBCSN10.0206. Required duty: direct replacement stationary vane segment for turbine row 2, with correct airfoil, platform, carrier fit, sealing and cooling interfaces, and throat area within the drawing band.	Material: FSX-414 cobalt base superalloy, vacuum investment cast, solid solution strengthened. Nominal 29.5 Cr, 10.5 Ni, 7.0 W, 0.25 C, balance Co. Coating: MCrAlY overlay per the governing drawing. Cooling: Film and convection cooled. Firing temperature capability: up to approximately 1,060 degrees C, engine class. Fixing: located and retained per the casing drawing. Sealing: seal wires and strips. Composition reference A2A-TV02-001.	Stationary second stage position. Gas temperature approximately 930 to 960 degrees C. Metal temperature approximately 780 to 830 degrees C with film and convective cooling. Thermal cycling, oxidation, hot corrosion, moderate erosion.	Vacuum investment casting. FPI, radiographic testing of the casting, dimensional and coordinate measuring machine inspection, coating audit, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
7	Part No.: A2A5116244-G001 PB No.: PB0000251007 Drawing item: MBCSN10.0307 Composition ref.: A2A-TV03-001	Standard Turbine Vane Segment, Row 3. Installation: Installed on the turbine stator carrier (vane carrier), turbine vane row 3, upper and lower halves, drawing "Turbine Stator", Item No.: MBCSN10.0307. Required duty: direct replacement stationary vane segment for turbine row 3, with correct airfoil, platform, carrier fit, sealing and cooling interfaces, and throat area within the drawing band.	Material: FSX-414 cobalt base superalloy, vacuum investment cast, solid solution strengthened. Nominal 29.5 Cr, 10.5 Ni, 7.0 W, 0.25 C, balance Co. Coating: Per drawing. Cooling: Reduced cooling duty. Firing temperature capability: up to approximately 1,060 degrees C, engine class. Fixing: located and retained per the casing drawing. Sealing: seal wires and strips. Composition reference A2A-TV03-001.	Stationary third stage position. Gas temperature approximately 780 to 820 degrees C. Metal temperature approximately 680 to 720 degrees C at reduced cooling duty. Thermal cycling, oxidation, low temperature hot corrosion, deposit formation.	Vacuum investment casting. FPI, radiographic testing of the casting, dimensional and coordinate measuring machine inspection, coating audit, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
8	Part No.: A2A5116244-G002 PB No.: PB0000251008 Drawing item: MBCSN90.0008 Composition ref.: A2A-TV03-001	Joint Vane Segment, Row 3. Installation: Installed on the turbine stator carrier (vane carrier), turbine vane row 3, upper and lower halves, drawing "Turbine Stator", Item No.: MBCSN90.0008. Required duty: direct replacement stationary vane segment for turbine row 3, with correct airfoil, platform, carrier fit, sealing and cooling interfaces, and throat area within the drawing band.	Material: FSX-414 cobalt base superalloy, vacuum investment cast, solid solution strengthened. Nominal 29.5 Cr, 10.5 Ni, 7.0 W, 0.25 C, balance Co. Coating: Per drawing. Cooling: Reduced cooling duty. Firing temperature capability: up to approximately 1,060 degrees C, engine class. Fixing: located and retained per the casing drawing. Sealing: seal wires and strips. Composition reference A2A-TV03-001.	Stationary third stage position. Gas temperature approximately 780 to 820 degrees C. Metal temperature approximately 680 to 720 degrees C at reduced cooling duty. Thermal cycling, oxidation, low temperature hot corrosion, deposit formation.	Vacuum investment casting. FPI, radiographic testing of the casting, dimensional and coordinate measuring machine inspection, coating audit, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
9	Part No.: A2A5116244-G003 PB No.: PB0000251009 Drawing item: MBCSN10.0309 Composition ref.: A2A-TV03-001	Instrumented Turbine Vane Segment, Row 3. Installation: Installed on the turbine stator carrier (vane carrier), turbine vane row 3, upper and lower halves, drawing "Turbine Stator", Item No.: MBCSN10.0309. Required duty: direct replacement stationary vane segment for turbine row 3, with correct airfoil, platform, carrier fit, sealing and cooling interfaces, and throat area within the drawing band.	Material: FSX-414 cobalt base superalloy, vacuum investment cast, solid solution strengthened. Nominal 29.5 Cr, 10.5 Ni, 7.0 W, 0.25 C, balance Co. Coating: Per drawing. Cooling: Reduced cooling duty. Firing temperature capability: up to approximately 1,060 degrees C, engine class. Fixing: located and retained per the casing drawing. Sealing: seal wires and strips. Composition reference A2A-TV03-001.	Stationary third stage position. Gas temperature approximately 780 to 820 degrees C. Metal temperature approximately 680 to 720 degrees C at reduced cooling duty. Thermal cycling, oxidation, low temperature hot corrosion, deposit formation.	Vacuum investment casting. FPI, radiographic testing of the casting, dimensional and coordinate measuring machine inspection, coating audit, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE

No.	Item identification	Requirement per the Bidding Documents and installation duty	Characteristics of the item offered by UNEW, Inc.	Operating conditions and working environment at the installed position	Manufacturing, inspection and interface control	Analysis and conclusion
10	Part No.: A2A5118611-G001 PB No.: PB0000251010 Drawing item: MBCSN10.0410 Composition ref.: A2A-TV04-001	Standard Turbine Vane Segment, Row 4. Installation: Installed on the turbine stator carrier (vane carrier), turbine vane row 4, upper and lower halves, drawing "Turbine Stator", Item No.: MBCSN10.0410. Required duty: direct replacement stationary vane segment for turbine row 4, with correct airfoil, platform, carrier fit, sealing and cooling interfaces, and throat area within the drawing band.	Material: FSX-414 cobalt base superalloy, vacuum investment cast, solid solution strengthened. Nominal 29.5 Cr, 10.5 Ni, 7.0 W, 0.25 C, balance Co. Coating: Per drawing. Cooling: Uncooled. Firing temperature capability: up to approximately 1,060 degrees C, engine class. Fixing: located and retained per the casing drawing. Sealing: seal wires and strips. Composition reference A2A-TV04-001.	Stationary exhaust stage position. Gas temperature approximately 620 to 660 degrees C, exhaust temperature approximately 540 degrees C. Metal temperature approximately 560 to 600 degrees C, uncooled. High aerodynamic loading into the exhaust diffuser, deposit formation, low temperature corrosion.	Vacuum investment casting. FPI, radiographic testing of the casting, dimensional and coordinate measuring machine inspection, coating audit, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
11	Part No.: A2A5118611-G002 PB No.: PB0000251011 Drawing item: MBCSN90.0011 Composition ref.: A2A-TV04-001	Joint Vane Segment, Row 4. Installation: Installed on the turbine stator carrier (vane carrier), turbine vane row 4, upper and lower halves, drawing "Turbine Stator", Item No.: MBCSN90.0011. Required duty: direct replacement stationary vane segment for turbine row 4, with correct airfoil, platform, carrier fit, sealing and cooling interfaces, and throat area within the drawing band.	Material: FSX-414 cobalt base superalloy, vacuum investment cast, solid solution strengthened. Nominal 29.5 Cr, 10.5 Ni, 7.0 W, 0.25 C, balance Co. Coating: Per drawing. Cooling: Uncooled. Firing temperature capability: up to approximately 1,060 degrees C, engine class. Fixing: located and retained per the casing drawing. Sealing: seal wires and strips. Composition reference A2A-TV04-001.	Stationary exhaust stage position. Gas temperature approximately 620 to 660 degrees C, exhaust temperature approximately 540 degrees C. Metal temperature approximately 560 to 600 degrees C, uncooled. High aerodynamic loading into the exhaust diffuser, deposit formation, low temperature corrosion.	Vacuum investment casting. FPI, radiographic testing of the casting, dimensional and coordinate measuring machine inspection, coating audit, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
12	Part No.: A2A5118611-G003 PB No.: PB0000251012 Drawing item: MBCSN10.0412 Composition ref.: A2A-TV04-001	Instrumented Turbine Vane Segment, Row 4. Installation: Installed on the turbine stator carrier (vane carrier), turbine vane row 4, upper and lower halves, drawing "Turbine Stator", Item No.: MBCSN10.0412. Required duty: direct replacement stationary vane segment for turbine row 4, with correct airfoil, platform, carrier fit, sealing and cooling interfaces, and throat area within the drawing band.	Material: FSX-414 cobalt base superalloy, vacuum investment cast, solid solution strengthened. Nominal 29.5 Cr, 10.5 Ni, 7.0 W, 0.25 C, balance Co. Coating: Per drawing. Cooling: Uncooled. Firing temperature capability: up to approximately 1,060 degrees C, engine class. Fixing: located and retained per the casing drawing. Sealing: seal wires and strips. Composition reference A2A-TV04-001.	Stationary exhaust stage position. Gas temperature approximately 620 to 660 degrees C, exhaust temperature approximately 540 degrees C. Metal temperature approximately 560 to 600 degrees C, uncooled. High aerodynamic loading into the exhaust diffuser, deposit formation, low temperature corrosion.	Vacuum investment casting. FPI, radiographic testing of the casting, dimensional and coordinate measuring machine inspection, coating audit, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE

Note applicable to every item in this table: form, fit and installation interfaces are controlled against the UNEW governing drawing and the as built machine configuration before release, and the order specific inspection and test plan is submitted for Owner approval before manufacture.

7.2 Turbine Blades, Items 13 to 23

No.	Item identification	Requirement per the Bidding Documents and installation duty	Characteristics of the item offered by UNEW, Inc.	Operating conditions and working environment at the installed position	Manufacturing, inspection and interface control	Analysis and conclusion
13	Part No.: A2A50012458-G001 PB No.: PB0000252001 Drawing item: MBCSN11.0113 Composition ref.: A2A-TB01-001	Standard Turbine Blade, Row 1. Installation: Installed on the turbine wheel row 1, blade root slots of the turbine disc, drawing "Turbine wheel 1", Item No.: MBCSN11.0113. Required duty: direct replacement rotating blade for turbine row 1, with correct airfoil, fir tree root, platform, shroud and cooling interfaces, and moment weight class controlled for rotor balance.	Material: IN738LC nickel base superalloy, vacuum investment cast, gamma prime precipitation strengthened. Nominal 16.0 Cr, 8.5 Co, 3.4 Ti, 3.4 Al, 2.6 W, 1.75 Mo, 1.75 Ta, 0.9 Nb, balance Ni. Coating: MCrAlY + YSZ TBC, with internal aluminide diffusion coating on cooled surfaces. Cooling: Convection and film cooled, serpentine passages. Firing temperature capability: up to approximately 1,060 degrees C, engine class. Root and fixing: fir tree root with locking hardware included. Sealing: seal wires and strips. Composition reference A2A-TB01-001.	Rotating first stage position at 3,000 rpm. Gas temperature up to approximately 1,060 degrees C. Metal temperature approximately 830 to 870 degrees C with internal convective and film cooling. Highest combined thermal and centrifugal load of the machine, creep, low cycle and high cycle fatigue, oxidation, type I hot corrosion, tip rub.	Vacuum investment casting, FPI, radiographic testing of the casting, dimensional and coordinate measuring machine inspection, coating audit, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
14	Part No.: A2A50012458-G002 PB No.: PB0000252002 Drawing item: MBCSN11.0114 Composition ref.: A2A-TB01-001	Locking Turbine Blade, Row 1. Installation: Installed on the turbine wheel row 1, blade root slots of the turbine disc, drawing "Turbine wheel 1", Item No.: MBCSN11.0114. Required duty: direct replacement rotating blade for turbine row 1, with correct airfoil, fir tree root, platform, shroud and cooling interfaces, and moment weight class controlled for rotor balance.	Material: IN738LC nickel base superalloy, vacuum investment cast, gamma prime precipitation strengthened. Nominal 16.0 Cr, 8.5 Co, 3.4 Ti, 3.4 Al, 2.6 W, 1.75 Mo, 1.75 Ta, 0.9 Nb, balance Ni. Coating: MCrAlY + YSZ TBC, with internal aluminide diffusion coating on cooled surfaces. Cooling: Convection and film cooled, serpentine passages. Firing temperature capability: up to approximately 1,060 degrees C, engine class. Root and fixing: fir tree root with locking hardware included. Sealing: seal wires and strips. Composition reference A2A-TB01-001.	Rotating first stage position at 3,000 rpm. Gas temperature up to approximately 1,060 degrees C. Metal temperature approximately 830 to 870 degrees C with internal convective and film cooling. Highest combined thermal and centrifugal load of the machine, creep, low cycle and high cycle fatigue, oxidation, type I hot corrosion, tip rub.	Vacuum investment casting, FPI, radiographic testing of the casting, dimensional and coordinate measuring machine inspection, coating audit, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
15	Part No.: A2A50012458-G003 PB No.: PB0000252003 Drawing item: MBCSN90.0015 Composition ref.: A2A-TB01-001	Weighted / Balanced Segment Blade, Row 1. Installation: Installed on the turbine wheel row 1, blade root slots of the turbine disc, drawing "Turbine wheel 1", Item No.: MBCSN90.0015. Required duty: direct replacement rotating blade for turbine row 1, with correct airfoil, fir tree root, platform, shroud and cooling interfaces, and moment weight class controlled for rotor balance.	Material: IN738LC nickel base superalloy, vacuum investment cast, gamma prime precipitation strengthened. Nominal 16.0 Cr, 8.5 Co, 3.4 Ti, 3.4 Al, 2.6 W, 1.75 Mo, 1.75 Ta, 0.9 Nb, balance Ni. Coating: MCrAlY + YSZ TBC, with internal aluminide diffusion coating on cooled surfaces. Cooling: Convection and film cooled, serpentine passages. Firing temperature capability: up to approximately 1,060 degrees C, engine class. Root and fixing: fir tree root with locking hardware included. Sealing: seal wires and strips. Composition reference A2A-TB01-001.	Rotating first stage position at 3,000 rpm. Gas temperature up to approximately 1,060 degrees C. Metal temperature approximately 830 to 870 degrees C with internal convective and film cooling. Highest combined thermal and centrifugal load of the machine, creep, low cycle and high cycle fatigue, oxidation, type I hot corrosion, tip rub.	Vacuum investment casting, FPI, radiographic testing of the casting, dimensional and coordinate measuring machine inspection, coating audit, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
16	Part No.: A2A50014822-G001 PB No.: PB0000252004 Drawing item: MBCSN11.0216 Composition ref.: A2A-TB02-001	Standard Turbine Blade, Row 2. Installation: Installed on the turbine wheel row 2, blade root slots of the turbine disc, drawing "Turbine wheel 2", Item No.: MBCSN11.0216. Required duty: direct replacement rotating blade for turbine row 2, with correct airfoil, fir tree root, platform, shroud and cooling interfaces, and moment weight class controlled for rotor balance.	Material: IN738LC nickel base superalloy, vacuum investment cast, gamma prime precipitation strengthened. Nominal 16.0 Cr, 8.5 Co, 3.4 Ti, 3.4 Al, 2.6 W, 1.75 Mo, 1.75 Ta, 0.9 Nb, balance Ni. Coating: External MCrAlY, with internal aluminide diffusion coating on cooled surfaces. Cooling: Air cooled, cooling holes per drawing. Firing temperature capability: up to approximately 1,060 degrees C, engine class. Root and fixing: fir tree root with locking hardware included. Sealing: seal wires and strips. Composition reference A2A-TB02-001.	Rotating second stage position at 3,000 rpm. Gas temperature approximately 930 to 960 degrees C. Metal temperature approximately 760 to 810 degrees C with internal cooling. High centrifugal and thermal load, creep, thermal fatigue, oxidation and hot corrosion.	Vacuum investment casting, FPI, radiographic testing of the casting, dimensional and coordinate measuring machine inspection, coating audit, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
17	Part No.: A2A50014822-G002 PB No.: PB0000252005 Drawing item: MBCSN11.0217 Composition ref.: A2A-TB02-001	Locking Turbine Blade, Row 2. Installation: Installed on the turbine wheel row 2, blade root slots of the turbine disc, drawing "Turbine wheel 2", Item No.: MBCSN11.0217. Required duty: direct replacement rotating blade for turbine row 2, with correct airfoil, fir tree root, platform, shroud and cooling interfaces, and moment weight class controlled for rotor balance.	Material: IN738LC nickel base superalloy, vacuum investment cast, gamma prime precipitation strengthened. Nominal 16.0 Cr, 8.5 Co, 3.4 Ti, 3.4 Al, 2.6 W, 1.75 Mo, 1.75 Ta, 0.9 Nb, balance Ni. Coating: External MCrAlY, with internal aluminide diffusion coating on cooled surfaces. Cooling: Air cooled, cooling holes per drawing. Firing temperature capability: up to approximately 1,060 degrees C, engine class. Root and fixing: fir tree root with locking hardware included. Sealing: seal wires and strips. Composition reference A2A-TB02-001.	Rotating second stage position at 3,000 rpm. Gas temperature approximately 930 to 960 degrees C. Metal temperature approximately 760 to 810 degrees C with internal cooling. High centrifugal and thermal load, creep, thermal fatigue, oxidation and hot corrosion.	Vacuum investment casting, FPI, radiographic testing of the casting, dimensional and coordinate measuring machine inspection, coating audit, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE

No.	Item identification	Requirement per the Bidding Documents and installation duty	Characteristics of the item offered by UNEW, Inc.	Operating conditions and working environment at the installed position	Manufacturing, inspection and interface control	Analysis and conclusion
18	Part No.: A2A50014822-G003 PB No.: PB0000252006 Drawing item: MBCSN90.0018 Composition ref.: A2A-TB02-001	Weighted / Balanced Segment Blade, Row 2. Installation: Installed on the turbine wheel row 2, blade root slots of the turbine disc, drawing "Turbine wheel 2", Item No.: MBCSN90.0018. Required duty: direct replacement rotating blade for turbine row 2, with correct airfoil, fir tree root, platform, shroud and cooling interfaces, and moment weight class controlled for rotor balance.	Material: IN738LC nickel base superalloy, vacuum investment cast, gamma prime precipitation strengthened. Nominal 16.0 Cr, 8.5 Co, 3.4 Ti, 3.4 Al, 2.6 W, 1.75 Mo, 1.75 Ta, 0.9 Nb, balance Ni. Coating: External MCrAlY, with internal aluminate diffusion coating on cooled surfaces. Cooling: Air cooled, cooling holes per drawing. Firing temperature capability: up to approximately 1,060 degrees C, engine class. Root and fixing: fir tree root with locking hardware included. Sealing: seal wires and strips. Composition reference A2A-TB02-001.	Rotating second stage position at 3,000 rpm. Gas temperature approximately 930 to 960 degrees C. Metal temperature approximately 760 to 810 degrees C with internal cooling. High centrifugal and thermal load, creep, thermal fatigue, oxidation and hot corrosion.	Vacuum investment casting. FPI, radiographic testing of the casting, dimensional and coordinate measuring machine inspection, coating audit, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
19	Part No.: A2A50113110-G001 PB No.: PB0000252007 Drawing item: MBCSN11.0319 Composition ref.: A2A-TB03-001	Standard Turbine Blade, Row 3. Installation: Installed on the turbine wheel row 3, blade root slots of the turbine disc, drawing "Turbine wheel 3", Item No.: MBCSN11.0319. Required duty: direct replacement rotating blade for turbine row 3, with correct airfoil, fir tree root, platform, shroud and cooling interfaces, and moment weight class controlled for rotor balance.	Material: IN738LC nickel base superalloy, vacuum investment cast, gamma prime precipitation strengthened. Nominal 16.0 Cr, 8.5 Co, 3.4 Ti, 3.4 Al, 2.6 W, 1.75 Mo, 1.75 Ta, 0.9 Nb, balance Ni. Coating: MCrAlY overlay per the governing drawing. Cooling: Reduced cooling duty. Firing temperature capability: up to approximately 1,060 degrees C, engine class. Root and fixing: fir tree root with locking hardware included. Sealing: seal wires and strips. Composition reference A2A-TB03-001.	Rotating third stage position at 3,000 rpm. Gas temperature approximately 780 to 820 degrees C. Metal temperature approximately 660 to 710 degrees C. High centrifugal load, shroud contact loading, fatigue, oxidation, deposit formation.	Vacuum investment casting. FPI, radiographic testing of the casting, dimensional and coordinate measuring machine inspection, coating audit, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
20	Part No.: A2A50113110-G002 PB No.: PB0000252008 Drawing item: MBCSN11.0320 Composition ref.: A2A-TB03-001	Locking Turbine Blade, Row 3. Installation: Installed on the turbine wheel row 3, blade root slots of the turbine disc, drawing "Turbine wheel 3", Item No.: MBCSN11.0320. Required duty: direct replacement rotating blade for turbine row 3, with correct airfoil, fir tree root, platform, shroud and cooling interfaces, and moment weight class controlled for rotor balance.	Material: IN738LC nickel base superalloy, vacuum investment cast, gamma prime precipitation strengthened. Nominal 16.0 Cr, 8.5 Co, 3.4 Ti, 3.4 Al, 2.6 W, 1.75 Mo, 1.75 Ta, 0.9 Nb, balance Ni. Coating: MCrAlY overlay per the governing drawing. Cooling: Reduced cooling duty. Firing temperature capability: up to approximately 1,060 degrees C, engine class. Root and fixing: fir tree root with locking hardware included. Sealing: seal wires and strips. Composition reference A2A-TB03-001.	Rotating third stage position at 3,000 rpm. Gas temperature approximately 780 to 820 degrees C. Metal temperature approximately 660 to 710 degrees C. High centrifugal load, shroud contact loading, fatigue, oxidation, deposit formation.	Vacuum investment casting. FPI, radiographic testing of the casting, dimensional and coordinate measuring machine inspection, coating audit, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
21	Part No.: A2A50113110-G003 PB No.: PB0000252009 Drawing item: MBCSN90.0021 Composition ref.: A2A-TB03-001	Weighted / Balanced Segment Blade, Row 3. Installation: Installed on the turbine wheel row 3, blade root slots of the turbine disc, drawing "Turbine wheel 3", Item No.: MBCSN90.0021. Required duty: direct replacement rotating blade for turbine row 3, with correct airfoil, fir tree root, platform, shroud and cooling interfaces, and moment weight class controlled for rotor balance.	Material: IN738LC nickel base superalloy, vacuum investment cast, gamma prime precipitation strengthened. Nominal 16.0 Cr, 8.5 Co, 3.4 Ti, 3.4 Al, 2.6 W, 1.75 Mo, 1.75 Ta, 0.9 Nb, balance Ni. Coating: MCrAlY overlay per the governing drawing. Cooling: Reduced cooling duty. Firing temperature capability: up to approximately 1,060 degrees C, engine class. Root and fixing: fir tree root with locking hardware included. Sealing: seal wires and strips. Composition reference A2A-TB03-001.	Rotating third stage position at 3,000 rpm. Gas temperature approximately 780 to 820 degrees C. Metal temperature approximately 660 to 710 degrees C. High centrifugal load, shroud contact loading, fatigue, oxidation, deposit formation.	Vacuum investment casting. FPI, radiographic testing of the casting, dimensional and coordinate measuring machine inspection, coating audit, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
22	Part No.: A2A50113110-G004 PB No.: PB0000252010 Drawing item: MBCSN11.0422 Composition ref.: A2A-TB04-001	Standard Turbine Blade, Row 4. Installation: Installed on the turbine wheel row 4, blade root slots of the turbine disc, drawing "Turbine wheel 4", Item No.: MBCSN11.0422. Required duty: direct replacement rotating blade for turbine row 4, with correct airfoil, fir tree root, platform, shroud and cooling interfaces, and moment weight class controlled for rotor balance.	Material: IN738LC nickel base superalloy, vacuum investment cast, gamma prime precipitation strengthened. Nominal 16.0 Cr, 8.5 Co, 3.4 Ti, 3.4 Al, 2.6 W, 1.75 Mo, 1.75 Ta, 0.9 Nb, balance Ni. Coating: Per drawing. Cooling: Uncooled, thin walled. Firing temperature capability: up to approximately 1,060 degrees C, engine class. Root and fixing: fir tree root with locking hardware included. Sealing: seal wires and strips. Composition reference A2A-TB04-001.	Rotating exhaust stage position at 3,000 rpm. Gas temperature approximately 620 to 660 degrees C. Metal temperature approximately 540 to 590 degrees C, uncooled. Largest airfoil of the turbine, highest centrifugal and vibratory load, shroud contact loading, deposit formation.	Vacuum investment casting. FPI, radiographic testing of the casting, dimensional and coordinate measuring machine inspection, coating audit, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE



No.	Item identification	Requirement per the Bidding Documents and installation duty	Characteristics of the item offered by UNEW, Inc.	Operating conditions and working environment at the installed position	Manufacturing, inspection and interface control	Analysis and conclusion
23	Part No.: A2A50113110-G005 PB No.: PB0000252011 Drawing item: MBCSN11.0423 Composition ref.: A2A-TB04-001	Locking Blades (Master Blades / Closing Blades), Row 4. Installation: Installed on the turbine wheel row 4, blade root slots of the turbine disc, drawing "Turbine wheel 4", Item No.: MBCSN11.0423. Required duty: direct replacement rotating blade for turbine row 4, with correct airfoil, fir tree root, platform, shroud and cooling interfaces, and moment weight class controlled for rotor balance.	Material: IN738LC nickel base superalloy, vacuum investment cast, gamma prime precipitation strengthened. Nominal 16.0 Cr, 8.5 Co, 3.4 Ti, 3.4 Al, 2.6 W, 1.75 Mo, 1.75 Ta, 0.9 Nb, balance Ni. Coating: Per drawing. Cooling: Uncooled, thin walled. Firing temperature capability: up to approximately 1,060 degrees C, engine class. Root and fixing: fir tree root with locking hardware included. Sealing: seal wires and strips. Composition reference A2A-TB04-001.	Rotating exhaust stage position at 3,000 rpm. Gas temperature approximately 620 to 660 degrees C. Metal temperature approximately 540 to 590 degrees C, uncooled. Largest airfoil of the turbine, highest centrifugal and vibratory load, shroud contact loading, deposit formation.	Vacuum investment casting. FPI, radiographic testing of the casting, dimensional and coordinate measuring machine inspection, coating audit, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE

Note applicable to every item in this table: form, fit and installation interfaces are controlled against the UNEW governing drawing and the as built machine configuration before release, and the order specific inspection and test plan is submitted for Owner approval before manufacture.

7.3 Compressor Blades, Items 24 to 55

No.	Item identification	Requirement per the Bidding Documents and installation duty	Characteristics of the item offered by UNEW, Inc.	Operating conditions and working environment at the installed position	Manufacturing, inspection and interface control	Analysis and conclusion
24	Part No.: A2A2001101-G001 PB No.: PB0000253001 Drawing item: MBCSN22.0123 Composition ref.: A2A-CB01-001	Standard Compressor Blade, Row 1. Installation: Installed on the compressor rotor, compressor blade row 1 (stage 1), Item No.: MBCSN22.0123. Required duty: direct replacement rotating compressor blade for stage 1, with correct airfoil, root form and moment weight class for the stage.	Material: Ti-6Al-4V to ASTM B348 / AMS 4928, material no. 3.7165, nominal 5.5 to 6.75 Al, 3.5 to 4.5 V, balance Ti. Maximum service temperature approximately 315 degrees C. Density 4.43 g/cm3. Surface and finish: Shot-peened, controlled finish airfoil. Root and fixing: machined dovetail root. Composition reference A2A-CB01-001.	Rotating front stage position at 3,000 rpm. Air temperature from site ambient at the inlet to approximately 120 degrees C at stage 4, pressure from atmospheric to approximately 2.5 bar. Transonic inlet flow, high centrifugal load, high cycle fatigue from flow excitation, salt laden and humid intake air, particulate and droplet erosion, fouling.	Precision forging and machining. FPI, dimensional and coordinate measuring machine inspection, hardness verification, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
25	Part No.: A2A2001101-G002 PB No.: PB0000253002 Drawing item: MBCSN22.0124 Composition ref.: A2A-CB01-001	Locking Compressor Blade, Row 1. Installation: Installed on the compressor rotor, compressor blade row 1 (stage 1), Item No.: MBCSN22.0124. Required duty: direct replacement rotating compressor blade for stage 1, with correct airfoil, root form and moment weight class for the stage.	Material: Ti-6Al-4V to ASTM B348 / AMS 4928, material no. 3.7165, nominal 5.5 to 6.75 Al, 3.5 to 4.5 V, balance Ti. Maximum service temperature approximately 315 degrees C. Density 4.43 g/cm3. Surface and finish: Shot-peened, controlled finish airfoil. Root and fixing: machined dovetail root. Composition reference A2A-CB01-001.	Rotating front stage position at 3,000 rpm. Air temperature from site ambient at the inlet to approximately 120 degrees C at stage 4, pressure from atmospheric to approximately 2.5 bar. Transonic inlet flow, high centrifugal load, high cycle fatigue from flow excitation, salt laden and humid intake air, particulate and droplet erosion, fouling.	Precision forging and machining. FPI, dimensional and coordinate measuring machine inspection, hardness verification, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
26	Part No.: A2A2001102-G001 PB No.: PB0000253003 Drawing item: MBCSN22.0225 Composition ref.: A2A-CB02-001	Standard Compressor Blade, Row 2. Installation: Installed on the compressor rotor, compressor blade row 2 (stage 2), Item No.: MBCSN22.0225. Required duty: direct replacement rotating compressor blade for stage 2, with correct airfoil, root form and moment weight class for the stage.	Material: Ti-6Al-4V to ASTM B348 / AMS 4928, material no. 3.7165, nominal 5.5 to 6.75 Al, 3.5 to 4.5 V, balance Ti. Maximum service temperature approximately 315 degrees C. Density 4.43 g/cm3. Surface and finish: Shot-peened, controlled finish airfoil. Root and fixing: machined dovetail root. Composition reference A2A-CB02-001.	Rotating front stage position at 3,000 rpm. Air temperature from site ambient at the inlet to approximately 120 degrees C at stage 4, pressure from atmospheric to approximately 2.5 bar. Transonic inlet flow, high centrifugal load, high cycle fatigue from flow excitation, salt laden and humid intake air, particulate and droplet erosion, fouling.	Precision forging and machining. FPI, dimensional and coordinate measuring machine inspection, hardness verification, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
27	Part No.: A2A2001102-G002 PB No.: PB0000253004 Drawing item: MBCSN22.0226 Composition ref.: A2A-CB02-001	Locking Compressor Blade, Row 2. Installation: Installed on the compressor rotor, compressor blade row 2 (stage 2), Item No.: MBCSN22.0226. Required duty: direct replacement rotating compressor blade for stage 2, with correct airfoil, root form and moment weight class for the stage.	Material: Ti-6Al-4V to ASTM B348 / AMS 4928, material no. 3.7165, nominal 5.5 to 6.75 Al, 3.5 to 4.5 V, balance Ti. Maximum service temperature approximately 315 degrees C. Density 4.43 g/cm3. Surface and finish: Shot-peened, controlled finish airfoil. Root and fixing: machined dovetail root. Composition reference A2A-CB02-001.	Rotating front stage position at 3,000 rpm. Air temperature from site ambient at the inlet to approximately 120 degrees C at stage 4, pressure from atmospheric to approximately 2.5 bar. Transonic inlet flow, high centrifugal load, high cycle fatigue from flow excitation, salt laden and humid intake air, particulate and droplet erosion, fouling.	Precision forging and machining. FPI, dimensional and coordinate measuring machine inspection, hardness verification, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
28	Part No.: A2A2001103-G001 PB No.: PB0000253005 Drawing item: MBCSN22.0327 Composition ref.: A2A-CB03-001	Standard Compressor Blade, Row 3. Installation: Installed on the compressor rotor, compressor blade row 3 (stage 3), Item No.: MBCSN22.0327. Required duty: direct replacement rotating compressor blade for stage 3, with correct airfoil, root form and moment weight class for the stage.	Material: Ti-6Al-4V to ASTM B348 / AMS 4928, material no. 3.7165, nominal 5.5 to 6.75 Al, 3.5 to 4.5 V, balance Ti. Maximum service temperature approximately 315 degrees C. Density 4.43 g/cm3. Surface and finish: Shot-peened, controlled finish airfoil. Root and fixing: machined dovetail root. Composition reference A2A-CB03-001.	Rotating front stage position at 3,000 rpm. Air temperature from site ambient at the inlet to approximately 120 degrees C at stage 4, pressure from atmospheric to approximately 2.5 bar. Transonic inlet flow, high centrifugal load, high cycle fatigue from flow excitation, salt laden and humid intake air, particulate and droplet erosion, fouling.	Precision forging and machining. FPI, dimensional and coordinate measuring machine inspection, hardness verification, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE

No.	Item identification	Requirement per the Bidding Documents and installation duty	Characteristics of the item offered by UNEW, Inc.	Operating conditions and working environment at the installed position	Manufacturing, inspection and interface control	Analysis and conclusion
29	Part No.: A2A2001103-G002 PB No.: PB0000253006 Drawing item: MBCSN22.0328 Composition ref.: A2A-CB03-001	Locking Compressor Blade, Row 3. Installation: Installed on the compressor rotor, compressor blade row 3 (stage 3), Item No.: MBCSN22.0328. Required duty: direct replacement rotating compressor blade for stage 3, with correct airfoil, root form and moment weight class for the stage.	Material: Ti-6Al-4V to ASTM B348 / AMS 4928, material no. 3.7165, nominal 5.5 to 6.75 Al, 3.5 to 4.5 V, balance Ti. Maximum service temperature approximately 315 degrees C. Density 4.43 g/cm3. Surface and finish: Shot-peened, controlled finish airfoil. Root and fixing: machined dovetail root. Composition reference A2A-CB03-001.	Rotating front stage position at 3,000 rpm. Air temperature from site ambient at the inlet to approximately 120 degrees C at stage 4, pressure from atmospheric to approximately 2.5 bar. Transonic inlet flow, high centrifugal load, high cycle fatigue from flow excitation, salt laden and humid intake air, particulate and droplet erosion, fouling.	Precision forging and machining. FPI, dimensional and coordinate measuring machine inspection, hardness verification, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
30	Part No.: A2A2001104-G001 PB No.: PB0000253007 Drawing item: MBCSN22.0429 Composition ref.: A2A-CB04-001	Standard Compressor Blade, Row 4. Installation: Installed on the compressor rotor, compressor blade row 4 (stage 4), Item No.: MBCSN22.0429. Required duty: direct replacement rotating compressor blade for stage 4, with correct airfoil, root form and moment weight class for the stage.	Material: Ti-6Al-4V to ASTM B348 / AMS 4928, material no. 3.7165, nominal 5.5 to 6.75 Al, 3.5 to 4.5 V, balance Ti. Maximum service temperature approximately 315 degrees C. Density 4.43 g/cm3. Surface and finish: Shot-peened, controlled finish airfoil. Root and fixing: machined dovetail root. Composition reference A2A-CB04-001.	Rotating front stage position at 3,000 rpm. Air temperature from site ambient at the inlet to approximately 120 degrees C at stage 4, pressure from atmospheric to approximately 2.5 bar. Transonic inlet flow, high centrifugal load, high cycle fatigue from flow excitation, salt laden and humid intake air, particulate and droplet erosion, fouling.	Precision forging and machining. FPI, dimensional and coordinate measuring machine inspection, hardness verification, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
31	Part No.: A2A2001104-G002 PB No.: PB0000253008 Drawing item: MBCSN22.0430 Composition ref.: A2A-CB04-001	Locking Compressor Blade, Row 4. Installation: Installed on the compressor rotor, compressor blade row 4 (stage 4), Item No.: MBCSN22.0430. Required duty: direct replacement rotating compressor blade for stage 4, with correct airfoil, root form and moment weight class for the stage.	Material: Ti-6Al-4V to ASTM B348 / AMS 4928, material no. 3.7165, nominal 5.5 to 6.75 Al, 3.5 to 4.5 V, balance Ti. Maximum service temperature approximately 315 degrees C. Density 4.43 g/cm3. Surface and finish: Shot-peened, controlled finish airfoil. Root and fixing: machined dovetail root. Composition reference A2A-CB04-001.	Rotating front stage position at 3,000 rpm. Air temperature from site ambient at the inlet to approximately 120 degrees C at stage 4, pressure from atmospheric to approximately 2.5 bar. Transonic inlet flow, high centrifugal load, high cycle fatigue from flow excitation, salt laden and humid intake air, particulate and droplet erosion, fouling.	Precision forging and machining. FPI, dimensional and coordinate measuring machine inspection, hardness verification, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
32	Part No.: A2A2001105-G001 PB No.: PB0000253009 Drawing item: MBCSN22.0531 Composition ref.: A2A-CB05-001	Standard Compressor Blade, Row 5. Installation: Installed on the compressor rotor, compressor blade row 5 (stage 5), Item No.: MBCSN22.0531. Required duty: direct replacement rotating compressor blade for stage 5, with correct airfoil, root form and moment weight class for the stage.	Material: X20Cr13 to EN 10088-3, material no. 1.4021, nominal 0.16 to 0.25 C, 12.0 to 14.0 Cr, balance Fe. Maximum service temperature approximately 400 degrees C. Density 7.70 g/cm3. Surface and finish: Hardened/tempered, controlled finish airfoil. Root and fixing: machined dovetail root. Composition reference A2A-CB05-001.	Rotating mid stage position at 3,000 rpm. Air temperature approximately 120 to 260 degrees C, pressure approximately 2.5 to 6.5 bar. High centrifugal load, high cycle fatigue, fouling and deposit formation, corrosion from carry over of salt and moisture from the intake air.	Precision forging and machining. FPI, dimensional and coordinate measuring machine inspection, hardness verification, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
33	Part No.: A2A2001105-G002 PB No.: PB0000253010 Drawing item: MBCSN22.0532 Composition ref.: A2A-CB05-001	Locking Compressor Blade, Row 5. Installation: Installed on the compressor rotor, compressor blade row 5 (stage 5), Item No.: MBCSN22.0532. Required duty: direct replacement rotating compressor blade for stage 5, with correct airfoil, root form and moment weight class for the stage.	Material: X20Cr13 to EN 10088-3, material no. 1.4021, nominal 0.16 to 0.25 C, 12.0 to 14.0 Cr, balance Fe. Maximum service temperature approximately 400 degrees C. Density 7.70 g/cm3. Surface and finish: Hardened/tempered, controlled finish airfoil. Root and fixing: machined dovetail root. Composition reference A2A-CB05-001.	Rotating mid stage position at 3,000 rpm. Air temperature approximately 120 to 260 degrees C, pressure approximately 2.5 to 6.5 bar. High centrifugal load, high cycle fatigue, fouling and deposit formation, corrosion from carry over of salt and moisture from the intake air.	Precision forging and machining. FPI, dimensional and coordinate measuring machine inspection, hardness verification, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE

No.	Item identification	Requirement per the Bidding Documents and installation duty	Characteristics of the item offered by UNEW, Inc.	Operating conditions and working environment at the installed position	Manufacturing, inspection and interface control	Analysis and conclusion
34	Part No.: A2A2001106-G001 PB No.: PB0000253011 Drawing item: MBCSN22.0633 Composition ref.: A2A-CB06-001	Standard Compressor Blade, Row 6. Installation: Installed on the compressor rotor, compressor blade row 6 (stage 6), Item No.: MBCSN22.0633. Required duty: direct replacement rotating compressor blade for stage 6, with correct airfoil, root form and moment weight class for the stage.	Material: X20Cr13 to EN 10088-3, material no. 1.4021, nominal 0.16 to 0.25 C, 12.0 to 14.0 Cr, balance Fe. Maximum service temperature approximately 400 degrees C. Density 7.70 g/cm3. Surface and finish: Hardened/tempered, controlled finish airfoil. Root and fixing: machined dovetail root. Composition reference A2A-CB06-001.	Rotating mid stage position at 3,000 rpm. Air temperature approximately 120 to 260 degrees C, pressure approximately 2.5 to 6.5 bar. High centrifugal load, high cycle fatigue, fouling and deposit formation, corrosion from carry over of salt and moisture from the intake air.	Precision forging and machining. FPI, dimensional and coordinate measuring machine inspection, hardness verification, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
35	Part No.: A2A2001106-G002 PB No.: PB0000253012 Drawing item: MBCSN22.0634 Composition ref.: A2A-CB06-001	Locking Compressor Blade, Row 6. Installation: Installed on the compressor rotor, compressor blade row 6 (stage 6), Item No.: MBCSN22.0634. Required duty: direct replacement rotating compressor blade for stage 6, with correct airfoil, root form and moment weight class for the stage.	Material: X20Cr13 to EN 10088-3, material no. 1.4021, nominal 0.16 to 0.25 C, 12.0 to 14.0 Cr, balance Fe. Maximum service temperature approximately 400 degrees C. Density 7.70 g/cm3. Surface and finish: Hardened/tempered, controlled finish airfoil. Root and fixing: machined dovetail root. Composition reference A2A-CB06-001.	Rotating mid stage position at 3,000 rpm. Air temperature approximately 120 to 260 degrees C, pressure approximately 2.5 to 6.5 bar. High centrifugal load, high cycle fatigue, fouling and deposit formation, corrosion from carry over of salt and moisture from the intake air.	Precision forging and machining. FPI, dimensional and coordinate measuring machine inspection, hardness verification, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
36	Part No.: A2A2001107-G001 PB No.: PB0000253013 Drawing item: MBCSN22.0735 Composition ref.: A2A-CB07-001	Standard Compressor Blade, Row 7. Installation: Installed on the compressor rotor, compressor blade row 7 (stage 7), Item No.: MBCSN22.0735. Required duty: direct replacement rotating compressor blade for stage 7, with correct airfoil, root form and moment weight class for the stage.	Material: X20Cr13 to EN 10088-3, material no. 1.4021, nominal 0.16 to 0.25 C, 12.0 to 14.0 Cr, balance Fe. Maximum service temperature approximately 400 degrees C. Density 7.70 g/cm3. Surface and finish: Hardened/tempered, controlled finish airfoil. Root and fixing: machined dovetail root. Composition reference A2A-CB07-001.	Rotating mid stage position at 3,000 rpm. Air temperature approximately 120 to 260 degrees C, pressure approximately 2.5 to 6.5 bar. High centrifugal load, high cycle fatigue, fouling and deposit formation, corrosion from carry over of salt and moisture from the intake air.	Precision forging and machining. FPI, dimensional and coordinate measuring machine inspection, hardness verification, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
37	Part No.: A2A2001107-G002 PB No.: PB0000253014 Drawing item: MBCSN22.0736 Composition ref.: A2A-CB07-001	Locking Compressor Blade, Row 7. Installation: Installed on the compressor rotor, compressor blade row 7 (stage 7), Item No.: MBCSN22.0736. Required duty: direct replacement rotating compressor blade for stage 7, with correct airfoil, root form and moment weight class for the stage.	Material: X20Cr13 to EN 10088-3, material no. 1.4021, nominal 0.16 to 0.25 C, 12.0 to 14.0 Cr, balance Fe. Maximum service temperature approximately 400 degrees C. Density 7.70 g/cm3. Surface and finish: Hardened/tempered, controlled finish airfoil. Root and fixing: machined dovetail root. Composition reference A2A-CB07-001.	Rotating mid stage position at 3,000 rpm. Air temperature approximately 120 to 260 degrees C, pressure approximately 2.5 to 6.5 bar. High centrifugal load, high cycle fatigue, fouling and deposit formation, corrosion from carry over of salt and moisture from the intake air.	Precision forging and machining. FPI, dimensional and coordinate measuring machine inspection, hardness verification, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
38	Part No.: A2A2001108-G001 PB No.: PB0000253015 Drawing item: MBCSN22.0837 Composition ref.: A2A-CB08-001	Standard Compressor Blade, Row 8. Installation: Installed on the compressor rotor, compressor blade row 8 (stage 8), Item No.: MBCSN22.0837. Required duty: direct replacement rotating compressor blade for stage 8, with correct airfoil, root form and moment weight class for the stage.	Material: X20Cr13 to EN 10088-3, material no. 1.4021, nominal 0.16 to 0.25 C, 12.0 to 14.0 Cr, balance Fe. Maximum service temperature approximately 400 degrees C. Density 7.70 g/cm3. Surface and finish: Hardened/tempered, controlled finish airfoil. Root and fixing: machined dovetail root. Composition reference A2A-CB08-001.	Rotating mid stage position at 3,000 rpm. Air temperature approximately 120 to 260 degrees C, pressure approximately 2.5 to 6.5 bar. High centrifugal load, high cycle fatigue, fouling and deposit formation, corrosion from carry over of salt and moisture from the intake air.	Precision forging and machining. FPI, dimensional and coordinate measuring machine inspection, hardness verification, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE

No.	Item identification	Requirement per the Bidding Documents and installation duty	Characteristics of the item offered by UNEW, Inc.	Operating conditions and working environment at the installed position	Manufacturing, inspection and interface control	Analysis and conclusion
39	Part No.: A2A2001108-G002 PB No.: PB0000253016 Drawing item: MBCSN22.0838 Composition ref.: A2A-CB08-001	Locking Compressor Blade, Row 8. Installation: Installed on the compressor rotor, compressor blade row 8 (stage 8), Item No.: MBCSN22.0838. Required duty: direct replacement rotating compressor blade for stage 8, with correct airfoil, root form and moment weight class for the stage.	Material: X20Cr13 to EN 10088-3, material no. 1.4021, nominal 0.16 to 0.25 C, 12.0 to 14.0 Cr, balance Fe. Maximum service temperature approximately 400 degrees C. Density 7.70 g/cm3. Surface and finish: Hardened/tempered, controlled finish airfoil. Root and fixing: machined dovetail root. Composition reference A2A-CB08-001.	Rotating mid stage position at 3,000 rpm. Air temperature approximately 120 to 260 degrees C, pressure approximately 2.5 to 6.5 bar. High centrifugal load, high cycle fatigue, fouling and deposit formation, corrosion from carry over of salt and moisture from the intake air.	Precision forging and machining. FPI, dimensional and coordinate measuring machine inspection, hardness verification, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
40	Part No.: A2A2001109-G001 PB No.: PB0000253017 Drawing item: MBCSN22.0939 Composition ref.: A2A-CB09-001	Standard Compressor Blade, Row 9. Installation: Installed on the compressor rotor, compressor blade row 9 (stage 9), Item No.: MBCSN22.0939. Required duty: direct replacement rotating compressor blade for stage 9, with correct airfoil, root form and moment weight class for the stage.	Material: X20Cr13 to EN 10088-3, material no. 1.4021, nominal 0.16 to 0.25 C, 12.0 to 14.0 Cr, balance Fe. Maximum service temperature approximately 400 degrees C. Density 7.70 g/cm3. Surface and finish: Hardened/tempered, controlled finish airfoil. Root and fixing: machined dovetail root. Composition reference A2A-CB09-001.	Rotating mid stage position at 3,000 rpm. Air temperature approximately 120 to 260 degrees C, pressure approximately 2.5 to 6.5 bar. High centrifugal load, high cycle fatigue, fouling and deposit formation, corrosion from carry over of salt and moisture from the intake air.	Precision forging and machining. FPI, dimensional and coordinate measuring machine inspection, hardness verification, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
41	Part No.: A2A2001109-G002 PB No.: PB0000253018 Drawing item: MBCSN22.0940 Composition ref.: A2A-CB09-001	Locking Compressor Blade, Row 9. Installation: Installed on the compressor rotor, compressor blade row 9 (stage 9), Item No.: MBCSN22.0940. Required duty: direct replacement rotating compressor blade for stage 9, with correct airfoil, root form and moment weight class for the stage.	Material: X20Cr13 to EN 10088-3, material no. 1.4021, nominal 0.16 to 0.25 C, 12.0 to 14.0 Cr, balance Fe. Maximum service temperature approximately 400 degrees C. Density 7.70 g/cm3. Surface and finish: Hardened/tempered, controlled finish airfoil. Root and fixing: machined dovetail root. Composition reference A2A-CB09-001.	Rotating mid stage position at 3,000 rpm. Air temperature approximately 120 to 260 degrees C, pressure approximately 2.5 to 6.5 bar. High centrifugal load, high cycle fatigue, fouling and deposit formation, corrosion from carry over of salt and moisture from the intake air.	Precision forging and machining. FPI, dimensional and coordinate measuring machine inspection, hardness verification, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
42	Part No.: A2A2001110-G001 PB No.: PB0000253019 Drawing item: MBCSN22.1041 Composition ref.: A2A-CB10-001	Standard Compressor Blade, Row 10. Installation: Installed on the compressor rotor, compressor blade row 10 (stage 10), Item No.: MBCSN22.1041. Required duty: direct replacement rotating compressor blade for stage 10, with correct airfoil, root form and moment weight class for the stage.	Material: X20Cr13 to EN 10088-3, material no. 1.4021, nominal 0.16 to 0.25 C, 12.0 to 14.0 Cr, balance Fe. Maximum service temperature approximately 400 degrees C. Density 7.70 g/cm3. Surface and finish: Hardened/tempered, controlled finish airfoil. Root and fixing: machined dovetail root. Composition reference A2A-CB10-001.	Rotating mid stage position at 3,000 rpm. Air temperature approximately 120 to 260 degrees C, pressure approximately 2.5 to 6.5 bar. High centrifugal load, high cycle fatigue, fouling and deposit formation, corrosion from carry over of salt and moisture from the intake air.	Precision forging and machining. FPI, dimensional and coordinate measuring machine inspection, hardness verification, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
43	Part No.: A2A2001110-G002 PB No.: PB0000253020 Drawing item: MBCSN22.1042 Composition ref.: A2A-CB10-001	Locking Compressor Blade, Row 10. Installation: Installed on the compressor rotor, compressor blade row 10 (stage 10), Item No.: MBCSN22.1042. Required duty: direct replacement rotating compressor blade for stage 10, with correct airfoil, root form and moment weight class for the stage.	Material: X20Cr13 to EN 10088-3, material no. 1.4021, nominal 0.16 to 0.25 C, 12.0 to 14.0 Cr, balance Fe. Maximum service temperature approximately 400 degrees C. Density 7.70 g/cm3. Surface and finish: Hardened/tempered, controlled finish airfoil. Root and fixing: machined dovetail root. Composition reference A2A-CB10-001.	Rotating mid stage position at 3,000 rpm. Air temperature approximately 120 to 260 degrees C, pressure approximately 2.5 to 6.5 bar. High centrifugal load, high cycle fatigue, fouling and deposit formation, corrosion from carry over of salt and moisture from the intake air.	Precision forging and machining. FPI, dimensional and coordinate measuring machine inspection, hardness verification, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE



No.	Item identification	Requirement per the Bidding Documents and installation duty	Characteristics of the item offered by UNEW, Inc.	Operating conditions and working environment at the installed position	Manufacturing, inspection and interface control	Analysis and conclusion
44	Part No.: A2A2001111-G001 PB No.: PB0000253021 Drawing item: MBCSN22.1143 Composition ref.: A2A-CB11-001	Standard Compressor Blade, Row 11. Installation: Installed on the compressor rotor, compressor blade row 11 (stage 11), Item No.: MBCSN22.1143. Required duty: direct replacement rotating compressor blade for stage 11, with correct airfoil, root form and moment weight class for the stage.	Material: X22CrMoV12-1 to EN 10302, material no. 1.4923, nominal 0.18 to 0.24 C, 11.0 to 12.5 Cr, 0.80 to 1.20 Mo, 0.25 to 0.35 V, balance Fe. Maximum service temperature approximately 580 degrees C. Density 7.70 g/cm3. Surface and finish: Hardened/tempered, controlled finish airfoil. Root and fixing: machined dovetail root. Composition reference A2A-CB11-001.	Rotating rear stage position at 3,000 rpm. Air temperature approximately 260 to 360 degrees C at compressor discharge, pressure up to approximately 11.1 bar at base load. High centrifugal and aerodynamic load, high cycle fatigue, elevated temperature strength requirement, fouling and deposit formation.	Precision forging and machining. FPI, dimensional and coordinate measuring machine inspection, hardness verification, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
45	Part No.: A2A2001111-G002 PB No.: PB0000253022 Drawing item: MBCSN22.1144 Composition ref.: A2A-CB11-001	Locking Compressor Blade, Row 11. Installation: Installed on the compressor rotor, compressor blade row 11 (stage 11), Item No.: MBCSN22.1144. Required duty: direct replacement rotating compressor blade for stage 11, with correct airfoil, root form and moment weight class for the stage.	Material: X22CrMoV12-1 to EN 10302, material no. 1.4923, nominal 0.18 to 0.24 C, 11.0 to 12.5 Cr, 0.80 to 1.20 Mo, 0.25 to 0.35 V, balance Fe. Maximum service temperature approximately 580 degrees C. Density 7.70 g/cm3. Surface and finish: Hardened/tempered, controlled finish airfoil. Root and fixing: machined dovetail root. Composition reference A2A-CB11-001.	Rotating rear stage position at 3,000 rpm. Air temperature approximately 260 to 360 degrees C at compressor discharge, pressure up to approximately 11.1 bar at base load. High centrifugal and aerodynamic load, high cycle fatigue, elevated temperature strength requirement, fouling and deposit formation.	Precision forging and machining. FPI, dimensional and coordinate measuring machine inspection, hardness verification, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
46	Part No.: A2A2001112-G001 PB No.: PB0000253023 Drawing item: MBCSN22.1245 Composition ref.: A2A-CB12-001	Standard Compressor Blade, Row 12. Installation: Installed on the compressor rotor, compressor blade row 12 (stage 12), Item No.: MBCSN22.1245. Required duty: direct replacement rotating compressor blade for stage 12, with correct airfoil, root form and moment weight class for the stage.	Material: X22CrMoV12-1 to EN 10302, material no. 1.4923, nominal 0.18 to 0.24 C, 11.0 to 12.5 Cr, 0.80 to 1.20 Mo, 0.25 to 0.35 V, balance Fe. Maximum service temperature approximately 580 degrees C. Density 7.70 g/cm3. Surface and finish: Hardened/tempered, controlled finish airfoil. Root and fixing: machined dovetail root. Composition reference A2A-CB12-001.	Rotating rear stage position at 3,000 rpm. Air temperature approximately 260 to 360 degrees C at compressor discharge, pressure up to approximately 11.1 bar at base load. High centrifugal and aerodynamic load, high cycle fatigue, elevated temperature strength requirement, fouling and deposit formation.	Precision forging and machining. FPI, dimensional and coordinate measuring machine inspection, hardness verification, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
47	Part No.: A2A2001112-G002 PB No.: PB0000253024 Drawing item: MBCSN22.1246 Composition ref.: A2A-CB12-001	Locking Compressor Blade, Row 12. Installation: Installed on the compressor rotor, compressor blade row 12 (stage 12), Item No.: MBCSN22.1246. Required duty: direct replacement rotating compressor blade for stage 12, with correct airfoil, root form and moment weight class for the stage.	Material: X22CrMoV12-1 to EN 10302, material no. 1.4923, nominal 0.18 to 0.24 C, 11.0 to 12.5 Cr, 0.80 to 1.20 Mo, 0.25 to 0.35 V, balance Fe. Maximum service temperature approximately 580 degrees C. Density 7.70 g/cm3. Surface and finish: Hardened/tempered, controlled finish airfoil. Root and fixing: machined dovetail root. Composition reference A2A-CB12-001.	Rotating rear stage position at 3,000 rpm. Air temperature approximately 260 to 360 degrees C at compressor discharge, pressure up to approximately 11.1 bar at base load. High centrifugal and aerodynamic load, high cycle fatigue, elevated temperature strength requirement, fouling and deposit formation.	Precision forging and machining. FPI, dimensional and coordinate measuring machine inspection, hardness verification, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
48	Part No.: A2A2001113-G001 PB No.: PB0000253025 Drawing item: MBCSN22.1347 Composition ref.: A2A-CB13-001	Standard Compressor Blade, Row 13. Installation: Installed on the compressor rotor, compressor blade row 13 (stage 13), Item No.: MBCSN22.1347. Required duty: direct replacement rotating compressor blade for stage 13, with correct airfoil, root form and moment weight class for the stage.	Material: X22CrMoV12-1 to EN 10302, material no. 1.4923, nominal 0.18 to 0.24 C, 11.0 to 12.5 Cr, 0.80 to 1.20 Mo, 0.25 to 0.35 V, balance Fe. Maximum service temperature approximately 580 degrees C. Density 7.70 g/cm3. Surface and finish: Hardened/tempered, controlled finish airfoil. Root and fixing: machined dovetail root. Composition reference A2A-CB13-001.	Rotating rear stage position at 3,000 rpm. Air temperature approximately 260 to 360 degrees C at compressor discharge, pressure up to approximately 11.1 bar at base load. High centrifugal and aerodynamic load, high cycle fatigue, elevated temperature strength requirement, fouling and deposit formation.	Precision forging and machining. FPI, dimensional and coordinate measuring machine inspection, hardness verification, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE

No.	Item identification	Requirement per the Bidding Documents and installation duty	Characteristics of the item offered by UNEW, Inc.	Operating conditions and working environment at the installed position	Manufacturing, inspection and interface control	Analysis and conclusion
49	Part No.: A2A2001113-G002 PB No.: PB0000253026 Drawing item: MBCSN22.1348 Composition ref.: A2A-CB13-001	Locking Compressor Blade, Row 13. Installation: Installed on the compressor rotor, compressor blade row 13 (stage 13). Item No.: MBCSN22.1348. Required duty: direct replacement rotating compressor blade for stage 13, with correct airfoil, root form and moment weight class for the stage.	Material: X22CrMoV12-1 to EN 10302, material no. 1.4923, nominal 0.18 to 0.24 C, 11.0 to 12.5 Cr, 0.80 to 1.20 Mo, 0.25 to 0.35 V, balance Fe. Maximum service temperature approximately 580 degrees C. Density 7.70 g/cm3. Surface and finish: Hardened/tempered, controlled finish airfoil. Root and fixing: machined dovetail root. Composition reference A2A-CB13-001.	Rotating rear stage position at 3,000 rpm. Air temperature approximately 260 to 360 degrees C at compressor discharge, pressure up to approximately 11.1 bar at base load. High centrifugal and aerodynamic load, high cycle fatigue, elevated temperature strength requirement, fouling and deposit formation.	Precision forging and machining. FPI, dimensional and coordinate measuring machine inspection, hardness verification, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
50	Part No.: A2A2001114-G001 PB No.: PB0000253027 Drawing item: MBCSN22.1449 Composition ref.: A2A-CB14-001	Standard Compressor Blade, Row 14. Installation: Installed on the compressor rotor, compressor blade row 14 (stage 14). Item No.: MBCSN22.1449. Required duty: direct replacement rotating compressor blade for stage 14, with correct airfoil, root form and moment weight class for the stage.	Material: X22CrMoV12-1 to EN 10302, material no. 1.4923, nominal 0.18 to 0.24 C, 11.0 to 12.5 Cr, 0.80 to 1.20 Mo, 0.25 to 0.35 V, balance Fe. Maximum service temperature approximately 580 degrees C. Density 7.70 g/cm3. Surface and finish: Hardened/tempered, controlled finish airfoil. Root and fixing: machined dovetail root. Composition reference A2A-CB14-001.	Rotating rear stage position at 3,000 rpm. Air temperature approximately 260 to 360 degrees C at compressor discharge, pressure up to approximately 11.1 bar at base load. High centrifugal and aerodynamic load, high cycle fatigue, elevated temperature strength requirement, fouling and deposit formation.	Precision forging and machining. FPI, dimensional and coordinate measuring machine inspection, hardness verification, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
51	Part No.: A2A2001114-G002 PB No.: PB0000253028 Drawing item: MBCSN22.1450 Composition ref.: A2A-CB14-001	Locking Compressor Blade, Row 14. Installation: Installed on the compressor rotor, compressor blade row 14 (stage 14). Item No.: MBCSN22.1450. Required duty: direct replacement rotating compressor blade for stage 14, with correct airfoil, root form and moment weight class for the stage.	Material: X22CrMoV12-1 to EN 10302, material no. 1.4923, nominal 0.18 to 0.24 C, 11.0 to 12.5 Cr, 0.80 to 1.20 Mo, 0.25 to 0.35 V, balance Fe. Maximum service temperature approximately 580 degrees C. Density 7.70 g/cm3. Surface and finish: Hardened/tempered, controlled finish airfoil. Root and fixing: machined dovetail root. Composition reference A2A-CB14-001.	Rotating rear stage position at 3,000 rpm. Air temperature approximately 260 to 360 degrees C at compressor discharge, pressure up to approximately 11.1 bar at base load. High centrifugal and aerodynamic load, high cycle fatigue, elevated temperature strength requirement, fouling and deposit formation.	Precision forging and machining. FPI, dimensional and coordinate measuring machine inspection, hardness verification, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
52	Part No.: A2A2001115-G001 PB No.: PB0000253029 Drawing item: MBCSN22.1551 Composition ref.: A2A-CB15-001	Standard Compressor Blade, Row 15. Installation: Installed on the compressor rotor, compressor blade row 15 (stage 15). Item No.: MBCSN22.1551. Required duty: direct replacement rotating compressor blade for stage 15, with correct airfoil, root form and moment weight class for the stage.	Material: X22CrMoV12-1 to EN 10302, material no. 1.4923, nominal 0.18 to 0.24 C, 11.0 to 12.5 Cr, 0.80 to 1.20 Mo, 0.25 to 0.35 V, balance Fe. Maximum service temperature approximately 580 degrees C. Density 7.70 g/cm3. Surface and finish: Hardened/tempered, controlled finish airfoil. Root and fixing: machined dovetail root. Composition reference A2A-CB15-001.	Rotating rear stage position at 3,000 rpm. Air temperature approximately 260 to 360 degrees C at compressor discharge, pressure up to approximately 11.1 bar at base load. High centrifugal and aerodynamic load, high cycle fatigue, elevated temperature strength requirement, fouling and deposit formation.	Precision forging and machining. FPI, dimensional and coordinate measuring machine inspection, hardness verification, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
53	Part No.: A2A2001115-G002 PB No.: PB0000253030 Drawing item: MBCSN22.1552 Composition ref.: A2A-CB15-001	Locking Compressor Blade, Row 15. Installation: Installed on the compressor rotor, compressor blade row 15 (stage 15). Item No.: MBCSN22.1552. Required duty: direct replacement rotating compressor blade for stage 15, with correct airfoil, root form and moment weight class for the stage.	Material: X22CrMoV12-1 to EN 10302, material no. 1.4923, nominal 0.18 to 0.24 C, 11.0 to 12.5 Cr, 0.80 to 1.20 Mo, 0.25 to 0.35 V, balance Fe. Maximum service temperature approximately 580 degrees C. Density 7.70 g/cm3. Surface and finish: Hardened/tempered, controlled finish airfoil. Root and fixing: machined dovetail root. Composition reference A2A-CB15-001.	Rotating rear stage position at 3,000 rpm. Air temperature approximately 260 to 360 degrees C at compressor discharge, pressure up to approximately 11.1 bar at base load. High centrifugal and aerodynamic load, high cycle fatigue, elevated temperature strength requirement, fouling and deposit formation.	Precision forging and machining. FPI, dimensional and coordinate measuring machine inspection, hardness verification, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE

No.	Item identification	Requirement per the Bidding Documents and installation duty	Characteristics of the item offered by UNEW, Inc.	Operating conditions and working environment at the installed position	Manufacturing, inspection and interface control	Analysis and conclusion
54	Part No.: A2A2001116-G001 PB No.: PB0000253031 Drawing item: MBCSN22.1653 Composition ref.: A2A-CB16-001	Standard Compressor Blade, Row 16. Installation: Installed on the compressor rotor, compressor blade row 16 (stage 16), Item No.: MBCSN22.1653. Required duty: direct replacement rotating compressor blade for stage 16, with correct airfoil, root form and moment weight class for the stage.	Material: X22CrMoV12-1 to EN 10302, material no. 1.4923, nominal 0.18 to 0.24 C, 11.0 to 12.5 Cr, 0.80 to 1.20 Mo, 0.25 to 0.35 V, balance Fe. Maximum service temperature approximately 580 degrees C. Density 7.70 g/cm3. Surface and finish: Hardened/tempered, controlled finish airfoil. Root and fixing: machined dovetail root. Composition reference A2A-CB16-001.	Rotating rear stage position at 3,000 rpm. Air temperature approximately 260 to 360 degrees C at compressor discharge, pressure up to approximately 11.1 bar at base load. High centrifugal and aerodynamic load, high cycle fatigue, elevated temperature strength requirement, fouling and deposit formation.	Precision forging and machining. FPI, dimensional and coordinate measuring machine inspection, hardness verification, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE
55	Part No.: A2A2001116-G002 PB No.: PB0000253032 Drawing item: MBCSN22.1654 Composition ref.: A2A-CB16-001	Locking Compressor Blade, Row 16. Installation: Installed on the compressor rotor, compressor blade row 16 (stage 16), Item No.: MBCSN22.1654. Required duty: direct replacement rotating compressor blade for stage 16, with correct airfoil, root form and moment weight class for the stage.	Material: X22CrMoV12-1 to EN 10302, material no. 1.4923, nominal 0.18 to 0.24 C, 11.0 to 12.5 Cr, 0.80 to 1.20 Mo, 0.25 to 0.35 V, balance Fe. Maximum service temperature approximately 580 degrees C. Density 7.70 g/cm3. Surface and finish: Hardened/tempered, controlled finish airfoil. Root and fixing: machined dovetail root. Composition reference A2A-CB16-001.	Rotating rear stage position at 3,000 rpm. Air temperature approximately 260 to 360 degrees C at compressor discharge, pressure up to approximately 11.1 bar at base load. High centrifugal and aerodynamic load, high cycle fatigue, elevated temperature strength requirement, fouling and deposit formation.	Precision forging and machining. FPI, dimensional and coordinate measuring machine inspection, hardness verification, material certification.	Same machine row or stage, same function and same installation interface as the item listed in the Bidding Documents. Material class, coating, cooling, temperature capability and inspection control are those required by the position. RESULT: EQUIVALENT AND COMPATIBLE

8. Analysis of Materials and Capability Margin

Five material grades are applied across the 55 offered items. Each grade is the established material class for the position in which it is applied on this engine family. The table below sets the capability of each grade against the actual service condition of the position and states the resulting margin. In every case the capability of the offered material exceeds the service condition of the position in which it is installed. No offered part is applied at or beyond the limit of its material capability.

Material grade offered	Applied to	Capability of the grade	Service condition at the installed position	Analysis of margin
IN738LC, cast nickel base superalloy	Turbine blades rows 1 to 4	Gamma prime precipitation strengthened. Creep rupture capability to approximately 980 degrees C metal temperature. High resistance to oxidation and hot corrosion	Maximum blade metal temperature approximately 870 degrees C at row 1 with cooling	Material capability exceeds the highest metal temperature of the application. Adequate for the full inspection interval
FSX-414, cast cobalt base superalloy	Turbine vanes rows 1 to 4	Solid solution strengthened. High thermal fatigue and hot corrosion resistance, service capability to approximately 950 degrees C with film and convective cooling and MCrAlY overlay coating	Maximum vane metal temperature approximately 850 to 900 degrees C at row 1 with film and convective cooling	Margin of approximately 50 degrees C above the highest metal temperature of the application. Grade selected specifically for the thermal fatigue duty of stationary vanes and is the standard material class for this application
Ti-6Al-4V (Grade 5)	Compressor blades stages 1 to 4	Maximum service temperature approximately 315 degrees C. Density 4.43 g/cm3. High specific strength and fatigue resistance	Maximum air temperature approximately 120 degrees C at stage 4	Margin of approximately 195 degrees C above the service temperature. Low density reduces centrifugal load on the rotor discs
X20Cr13 (1.4021)	Compressor blades stages 5 to 10	Martensitic stainless steel, maximum service temperature approximately 400 degrees C, 12 to 14 percent chromium for corrosion resistance	Maximum air temperature approximately 260 degrees C at stage 10	Margin of approximately 140 degrees C above the service temperature. Chromium content suited to the humid and salt bearing intake air at the site
X22CrMoV12-1 (1.4923)	Compressor blades stages 11 to 16	Creep resistant 12 percent chromium martensitic steel, maximum service temperature approximately 580 degrees C	Maximum air temperature approximately 360 degrees C at compressor discharge	Margin of approximately 220 degrees C above the service temperature. Grade selected for elevated temperature strength at the rear stages

8.1 Turbine blade material, IN738LC

IN738LC is a vacuum investment cast nickel base superalloy strengthened by gamma prime precipitation, with a nominal composition of 16.0 chromium, 8.5 cobalt, 3.4 titanium, 3.4 aluminium, 2.6 tungsten, 1.75 molybdenum, 1.75 tantalum, 0.9 niobium, 0.11 carbon and the balance nickel, in mass percent. The high chromium content provides resistance to hot corrosion and the gamma prime volume fraction provides creep strength at the metal temperatures reached in turbine rows 1 and 2. The low carbon variant is applied to control carbide morphology and to improve ductility and thermal fatigue resistance, which is the governing damage mechanism for blades subject to daily start and stop cycles. This grade is applied to all four rows of the offered blading.

8.2 Turbine vane material, FSX-414

FSX-414 is a vacuum investment cast cobalt base superalloy strengthened in solid solution, with a nominal composition of 29.5 chromium, 10.5 nickel, 7.0 tungsten, 0.25 carbon and the balance cobalt, in mass percent. Cobalt base alloys are applied to stationary vanes rather than to rotating blades because the governing damage mechanism of a vane is thermal fatigue and hot corrosion rather than creep under centrifugal load. The chromium content of 29.5 percent is substantially higher than that of the blade alloy and gives the vane a high resistance to type I and type II hot corrosion, which is the relevant mechanism for a machine operating in a coastal environment. This grade is applied to all four vane rows of the offered blading.

8.3 Compressor blade materials

The compressor blading is supplied in three grades selected by stage according to the air temperature, the mechanical loading and the corrosion environment of the stage. Stages 1 to 4 are supplied in Ti-6Al-4V (Grade 5) to ASTM B348 and AMS 4928, with a density of 4.43 grams per cubic centimetre. The low density of titanium reduces the centrifugal load transmitted to the rotor discs at the long forward airfoils, and the alloy provides the fatigue strength and erosion resistance required at the transonic inlet stages. Stages 5 to 10 are supplied in the martensitic stainless steel X20Cr13, material number 1.4021, to EN 10088-3, hardened and tempered, with 12 to 14 percent chromium for corrosion resistance in the humid intake air. Stages 11 to 16 are supplied in the creep resistant 12 percent chromium martensitic steel X22CrMoV12-1, material number 1.4923, to EN 10302, hardened and tempered, for the elevated temperature strength required at compressor discharge conditions. All compressor blades are supplied with a controlled finish airfoil and a machined dovetail root, and the titanium stages are shot peened to introduce a compressive residual stress at the surface and raise the fatigue strength of the airfoil.

8.4 Coating and surface protection

Turbine blades and vanes are supplied with high temperature protective coating systems consisting of an MCrAlY type overlay bond coat and, where the governing drawing requires it, a ceramic thermal barrier coating of yttria stabilised zirconia. Internal surfaces of cooled components carry an aluminide diffusion coating to resist intergranular oxidation of the cooling passages. The bond coat is applied by high velocity oxygen fuel spraying and the ceramic layer by air plasma spraying. Coating type, layer thickness and application process are defined for each component and confirmed against the governing drawing of that component. Coating processes are carried out under Nadcap accreditation through PRI, and coating thickness, adhesion and metallographic examination are recorded for each batch.

9. Nominal Material Composition of the Offered Grades

The compositions below are reproduced from document UNEW-MATL-001, Rev. 00. Values are nominal mass percent for the stated grade. Balance is nickel for IN738LC and cobalt for FSX-414.

9.1 Hot section cast superalloys

Grade	C	Cr	Co	Ni	Mo	W	Ta	Nb	Ti	Al	B	Zr	Applied to
IN738LC	0.11	16.0	8.5	Bal.	1.75	2.6	1.75	0.9	3.4	3.4	0.01	0.05	Turbine blades rows 1 to 4
FSX-414	0.25	29.5	Bal.	10.5	Not spec.	7.0	Not spec.	Not spec.	Not spec.	Not spec.	0.012 max	Not spec.	Turbine vanes rows 1 to 4

9.2 Compressor blade materials

Grade	Standard and material number	Maximum service temperature	Density (g/cm3)	Applied stages	Nominal composition, mass percent
Ti-6Al-4V (Grade 5)	ASTM B348 / AMS 4928, 3.7165	Approx. 315 degrees C	4.43	1 to 4	C 0.08 max, Al 5.5 to 6.75, V 3.5 to 4.5, Fe 0.40 max, N 0.05 max, O 0.20 max, H 0.015 max, balance Ti
X20Cr13	EN 10088-3, 1.4021	Approx. 400 degrees C	7.70	5 to 10	C 0.16 to 0.25, Si 1.0 max, Mn 1.5 max, P 0.040 max, S 0.015 max, Cr 12.0 to 14.0, N 0.11 max, balance Fe
X22CrMoV12-1	EN 10302, 1.4923	Approx. 580 degrees C	7.70	11 to 16	C 0.18 to 0.24, Si 0.5 max, Mn 0.40 to 0.90, P 0.025 max, S 0.015 max, Cr 11.0 to 12.5, Mo 0.80 to 1.20, Ni 0.30 to 0.80, V 0.25 to 0.35, balance Fe

10. Operating Conditions by Zone of the Machine

The operating condition of each zone at base load is stated below, together with the material and coating system offered for that zone. These are the conditions against which the material selection of the offered parts has been assessed in Section 8.

Zone of the machine	Gas or air temperature	Pressure	Principal loading and damage mechanisms	Material and coating offered
Compressor stages 1 to 4	Site ambient to approximately 120 degrees C	Atmospheric to approximately 2.5 bar	Salt laden and humid intake air, particulate and droplet erosion, fouling	Ti-6Al-4V (Grade 5), shot peened
Compressor stages 5 to 10	Approximately 120 to 260 degrees C	Approximately 2.5 to 6.5 bar	Carry over of salt and moisture, fouling and deposit formation, high cycle fatigue	X20Cr13 (1.4021), hardened and tempered
Compressor stages 11 to 16	Approximately 260 to 360 degrees C	Up to approximately 11.1 bar	Elevated temperature strength duty, fouling, high cycle fatigue	X22CrMoV12-1 (1.4923), hardened and tempered
Turbine vane and blade row 1	Gas up to approximately 1,060 degrees C	Approximately 10.5 bar	Oxidation, type I hot corrosion, thermal cycling, creep, tip rub	FSX-414 vanes, IN738LC blades, MCrAlY bond coat with YSZ thermal barrier coating and internal aluminide diffusion coating
Turbine vane and blade row 2	Gas approximately 930 to 960 degrees C	Approximately 6.0 bar	Oxidation, hot corrosion, thermal fatigue, creep	FSX-414 vanes, IN738LC blades, MCrAlY overlay coating
Turbine vane and blade row 3	Gas approximately 780 to 820 degrees C	Approximately 3.0 bar	Oxidation, deposit formation, fatigue, shroud contact loading	FSX-414 vanes, IN738LC blades, coating per drawing
Turbine vane and blade row 4	Gas approximately 620 to 660 degrees C	Approximately 1.1 bar	Deposit formation, low temperature corrosion, high vibratory loading	FSX-414 vanes, IN738LC blades, finish per drawing

11. Compatibility with the Si3D Configuration

The unit is in the Si3D configuration. The offered turbine vane and blade rows are manufactured to the Si3D aerodynamic profile of the governing drawing for each row, and not to the earlier profile of the base V94.2 machine. The compressor blading is manufactured to the profile of the sixteen stage compressor of this engine class. The offered parts are therefore compatible with the aerodynamic matching of the unit as installed, and no change to the flow path, to the clearances, to the control settings or to the operating concept of the unit is required in order to install them.

The offered parts are supplied as complete sets by row and by stage, including the standard blading, the locking or closing blading and, for the turbine rows, the weighted or balanced segment blading required for rotor balance, together with the seal wires, seal strips and locking hardware of the position. This allows a complete row to be renewed as a matched set, which is the condition under which the aerodynamic and mechanical behaviour of the row is defined.

12. Working Environment at the Site

The plant is located in the Phú Mỹ 1 Industrial Zone on the coastal plain of southern Viet Nam. The working environment of the machine is characterized by high ambient humidity through the year, salt bearing marine air drawn into the compressor intake, high mean ambient temperature and an industrial atmosphere. The machine operates principally on natural gas with distillate as back up fuel, in base load and mid merit duty with daily and weekly start and stop cycles.

This environment has been taken into account in the material selection of the offered parts in three respects. First, the intake air is humid and salt bearing, and carry over of salt into the compressor is the origin of pitting corrosion of compressor blading in coastal plants. The offered compressor blading is supplied in titanium at the wet forward stages and in 12 to 14 percent chromium martensitic stainless steel from stage 5 onward, which are the grades that resist that mechanism. Second, salt carried through the compressor and sulphur present in the fuel are the origin of hot corrosion of hot gas path parts. The offered vane material carries 29.5 percent chromium and the offered blade material carries 16.0 percent chromium with an MCrAlY overlay coating, which is the combination applied for hot corrosion duty. Third, the start and stop cycling of the unit imposes thermal fatigue on the hot gas path. The offered vane alloy is a solid solution strengthened cobalt base grade selected for thermal fatigue resistance, and the offered blade alloy is the low carbon variant of the nickel base grade, selected for the same reason.

For distillate operation the offered hot gas path parts carry the same coating system as for gas operation. Where the Owner advises a fuel specification with a vanadium, sodium or potassium content above the values normally treated for this engine class, UNEW will review the coating specification for the affected components before manufacture and will confirm the result to the Owner in writing.



13. Dimensional and Functional Interchangeability

All offered parts are manufactured to the UNEW governing drawing for the corresponding position in the machine, so that they install directly in the unit without modification of the machine, of the rotor, of the carriers or of any adjacent part. The following characteristics are measured and recorded and constitute the evidence of interchangeability.

Characteristic	Requirement	Evidence provided with the supply
Airfoil profile and platform geometry	To the UNEW governing drawing of the position	First article inspection report and coordinate measuring machine report
Root form, fir tree or dovetail engagement	Direct engagement with the installed disc or carrier	Gauge inspection and coordinate measurement record for every part
Throat area, turbine vane segments	Within the tolerance band of the governing drawing	Throat area measurement record for every vane segment
Moment weight, rotating blades	Classified for distribution around the disc	Moment weight measurement and distribution chart supplied with every blade set
Natural frequency, rotating blades	Within the band of the governing drawing where specified	Frequency test record for the applicable rows
Mass and overall dimensions	To the governing drawing	Dimensional and mass record for every part
Cooling configuration and flow	To the governing drawing for cooled components	Airflow test record where the drawing specifies it
Coating thickness at critical sections	Within the band of the governing drawing	Coating thickness and metallographic record for every batch
Sealing features, seal wires and strips	To the governing drawing of the position	Dimensional record of seal grooves and supply of matching sealing hardware
Serial number identification	Individual serial number on every part	Serial number register issued with the delivery documentation

14. Basis of the Statement that the Offered Parts Meet or Exceed the Requirement

UNEW supplies these parts as engineered replacements that meet or exceed the applicable requirements for form, fit, function, material capability, coating protection, interchangeability and service reliability. That statement rests on the following, each of which is verifiable by the Owner.

Element	What UNEW holds or performs	Effect for the Owner
Design ownership	UNEW holds the complete design record for every item offered, including the governing drawings, the part numbering, the drawing item location numbering, the material specification and the reference chemistry	Supply, repeat orders and spares continuity do not depend on any third party document, licence or release. The Owner deals with the organization that holds the design
Material control	Material grade, chemistry, heat treatment condition and mechanical properties are specified and verified by UNEW for each heat and lot	Chemical composition verified at the UNEW laboratory accredited to ISO/IEC 17025 through ANAB. Certification to EN 10204 type 3.1 or 3.2 with every delivery
Special process control	Coating, heat treatment and non destructive testing are performed under Nadcap accreditation through PRI	Independent audit of the special processes that determine the service life of a hot gas path part
Application engineering per order	For each supply UNEW reviews the machine configuration, the operating duty, the fuel condition, the site environment and the Owner requirement before manufacture	Where the service condition warrants it, the material selection, coating system, inspection criteria or quality hold points are strengthened above the minimum requirement for that position
Traceability	Every capital part is individually serialized and recorded against the delivery documentation	The Owner receives a serial number register that supports parts life tracking from installation to the next inspection
Single point technical responsibility	The same organization designs, manufactures, inspects, supplies, installs and services the parts	One accountable party for the part and for its performance in the machine, with no interface between a parts supplier and a service contractor

The statement is further supported by the in service record of identical scope supplied by UNEW to two utility operators of this engine class. Both records are available for verification directly with the operators concerned.

Plant and operator	Unit	Scope supplied by UNEW	Installed	Record to date
Central Térmica Bicentenario, Pilar, Córdoba, Argentina	Unit GT12, SGT5-2000E / V94.2, S/N 800784	Complete compressor blading, rows 1 to 16	November 2018	Inspected at the Hot Gas Path Inspection of 2022 after approximately 33,000 EOH and found in good condition. No blade removed, repaired or replaced. In excess of 7 years of continuous commercial service, still installed and in service
JEBEL ALI G55 Power Plant, Dubai, United Arab Emirates	Unit JEBEL ALI G51, SGT5-2000E / V94.2 (Si3D), S/N 600712	Complete hot gas path, vane and blade rows 1 to 4, and complete compressor blading, stages 1 to 16	January and February 2018	Inspected at the Combustion Inspections of 2022 and 2025 and found in good condition on both occasions. No blade removed, repaired or replaced. In excess of 8 years of continuous commercial service, still installed and in service

15. Verification Documents Supplied with the Goods

The following documents are supplied with the goods and constitute the objective evidence for the statements made in this analysis. They are issued under the UNEW quality management system, which holds ISO 9001 certification, ISO/IEC 17025 laboratory accreditation through ANAB and Nadcap accreditation through PRI for the applicable special processes.

Document	Content and scope
Certificate of Conformance	Issued for each part, referencing the part number, serial number and governing drawing
Material certification	EN 10204 type 3.1 or 3.2 certificate for each material heat or lot
Chemical composition report	Laboratory analysis at the UNEW ISO/IEC 17025 accredited laboratory, ANAB accredited scope
Mechanical property report	Tensile, hardness and where specified stress rupture testing of the material heat
Dimensional inspection report	First article inspection and production dimensional report against the governing drawing, including coordinate measurement
Non destructive testing report	Fluorescent penetrant inspection and radiographic examination of castings, by personnel qualified to ASNT SNT-TC-1A and ISO 9712
Coating report	Coating thickness, adhesion and metallographic examination for coated components, under Nadcap accredited process control
Throat area and moment weight record	Throat area record for vane segments and moment weight classification record for rotating blades
Serial number register	Individual serial number assigned to each part and recorded against the delivery documentation
Inspection and test plan	Order specific plan submitted for Owner approval before manufacture, with witness and hold points as required by the Owner

16. Compliance Conclusion

For each of the 55 offered items the material grade, the manufacturing route, the coating or surface protection, the cooling arrangement, the dimensional form, the fixing and sealing arrangement and the inspection control have been compared against the requirement of the Bidding Documents for the position in the machine in which the item is installed, and against the operating condition and working environment of that position.

In every case the offered item is assigned to the same turbine vane row, turbine wheel row or compressor stage as the required item, performs the same form, fit and function, is manufactured to the UNEW governing drawing of that position, carries the coating or surface protection required for the duty, and has a material capability that exceeds the service condition of the position with the margins recorded in Section 8.

UNEW, Inc. accordingly confirms, without reservation and without deviation, that the 55 offered line items are technically equivalent to the goods described in the Bidding Documents and are compatible for direct installation in the Siemens SGT5-2000E / V94.2 (Si3D) gas turbine unit of the Phú Mỹ 2.1 Ext. Thermal Power Plant, without modification of the unit and without any change to its operating concept. All verification records listed in Section 15 are available to the Owner for inspection at any time during manufacture and after delivery, and the order specific inspection and test plan is submitted for Owner approval before manufacture begins.



For and on behalf of UNEW, Inc.



Ronald Miller
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