**Requisition for Quotation**

**(Technical)**

**for**

**SHELL & TUBE HEAT EXCHANGERS**

|  |  |
| --- | --- |
| **Project No.** | **: N/A** |
| **Project Title** | **: ‘25년도 No.2 FCC TA 생산3팀 재질개선 투자** |
| **Location** | **: SK energy Ulsan Complex, KOREA** |
| **Client** | **: SK Energy** |

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| 0 | 2024.11.05 | 1st Issued | S.H.Lee |  | S.W. Yoon | B.M.Jeong |
| Rev. | Date | Description | Prp’d | Chk’d | Rew’d | App’d |

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*Articles marked with [ x ] shall be applied for this Requisition.*

1. **ITEMS AND QUANTITIES**

|  |  |  |  |
| --- | --- | --- | --- |
| NO. | ITEM NO. | DESCRIPTION | QUANTITY |
| 1 | AL-E5401A | Feed/Effluent Exchanger (Tube Bundle Only) | 1 Set |
| 2 | AL-E5407A | Deisobutanizer Condenser (Tube Bundle Only) | 8 Sets |
| 3 | AL-E5407B |
| 4 | AL-E5407C |
| 5 | AL-E5407D |
| 6 | AL-E5407E |
| 7 | AL-E5407F |
| 8 | AL-E5407G |
| 9 | AL-E5407H |
| 10 | AL-E5408 | Recycle Isobutane Cooler (Tube Bundle Only) | 1 Set |
| 11 | AL-E5419A | Deisobutanizer Reflux Cooler (Tube Bundle Only) | 2 Sets |
| 12 | AL-E5419B |
|  |  | Total | 12 Sets |
| [Special Note]  1) Vendor should consider materials of ‘Tubesheet and Tube’ are changed to SS316L  2) Vendor should summit the sub-vendor list and get an approval at the bidding stage. | | | |

1. **Scope of Work**

[ x ] Mechanical Design and Guarantee

[ x ] Manufacturing & Fabrication

[ ] PWHT, as per code, standard & specification

[ x ] Test and Inspection in accordance with Code & Specification;

[ x ] Hardness Test, if required

[ x ] NDE (PT/MT/UT/RT)

[ x ] Impact Test, if required

[ x ] Hydrostatic Test (Exclude for tube bundle only item)

[ x ] Rust preventive coating all machined and threaded parts

[ x ] Surface preparation and Painting, for assembly item ( [ x ] Primer [ x ] Up to Finish)

[ x ] Rust Prevention of Vessel Internals during transportation and site storage

( [ ] VCI 309 or equal [ x ] N2 charge at ( 1 ) Kg/cm2 )

[ x ] Design & Fabrication drawing work for platform and ladder, if required

[ x ] Shop installation of all internals and accessories at shop

[ x ] Protection & Packing ( [ x ] Inland [ ] Seaworthy)

[ x ] Inland Transportation

[ x ] ASME Code Stamping

[ ] Authorized Inspector’s Fee for ASME Code Stamp

[ x ] Application and Approval of Local Regulation & Law

[ x ] Documentation as per Vendor Data Requirement, Para.8 in this Material Requisition

[ x ] Others Specified in this Material Requisition

[ ] Anchor bolt size & quantity determination

1. **Scope of Supply**

Items and Quantities Shown on Para. 1, consist of following components;

[ x ] Equipment proper with all connections and its support

[ x ] Blind flange, gaskets, bolts and nuts for instrument nozzles, drain & vent nozzles

[ x ] Sliding plates/Teflon coated sliding plates for sliding side of saddle support

[ x ] Lifting devices for each removable parts and for whole equipment

[ x ] Pulling eye bolts for tube sheets of removable bundles with plug

[ x ] Impingement Baffle

[ x ] By pass sealing devices such as seal bars, seal strips and dummy tubes

[ x ] Tie rods and spacers

[ ] Tube maintenance sliding bar for all kettle type, and for removable type having bundle units over 400mm I.D

[ ] Clamp band for U-bend tube zone for Kettle type heat exchanger

[ ] Test ring for each shell unit (Min. 2 sets are required)

[ x ] Setting bolts, nuts and washers for mounting on structure

[ x ] Nameplates(304 SS) with its bracket

[ ] Clips or supports for insulation

[ ] Clips for platform and ladders, if required

[ ] Clips for piping support and guide

[ ] Clips for Fire-proofing

[ ] Grounding Connections

[ ] Jackscrew

[ x ] Steel cover plate, bolts/nuts and gaskets for nozzles during hydrostatic test & transportation

[ ] Spare Parts

[ ] For construction, commissioning and start-up,

- Gaskets for each manway, body flange, nozzles having blind flange, internal nozzles and other part specified to have gasket : 200%

- Bolts/Nuts for all internal parts, each manway, body flange, nozzles having blind flange, internal nozzles and other part specified to have bolts : 10% (min. 2 sets)

[ ] For One (1) Year Operational**(Optional)**

- Gaskets : 200%

- Bolts/nuts : 10% (min. 2 sets)

[ x ] All others as specified on data sheets or engineering drawing, project specifications and

code and standards

1. **Out of Scope**

[ x ] Anchor bolts and nuts

[ x ] Insulation Material and Work

[ x ] Fire Proofing Material and Work

1. **APPLICATION CODES AND STANDARDS**

The latest editions of codes and standards listed below shall be considered as integral parts of this Requisition. If the additional code and standard to the below is stipulated and referenced in the attached specifications, data sheets and drawings, those also shall be considered as integral parts of this Requisition.

[ x ] ASME Section VIII, Div.1 : Pressure Vessels

[ x ] TEMA Class “R” : Tubular Exchanger Manufacturer Association

[ x ] ASME Section II : Materials

[ x ] ASME Section IX : Welding and Brazing Qualification

[ x ] ASME Section V : Nondestructive Examination

[ x ] ASME B16.5 / 16.47 : Steel Pipe Flanges and Flanged Fittings

[ x ] API660 : Shell-and-tube Heat Exchangers

[ x ] WRC107/297 : Local Stress in Spherical and Cylindrical Shells

due to External Loadings

[ x ] KDS(Korea Design Standard) : Wind & Seismic

[ x ] NACE MR0103/0175 : National Association of Corrosion Engineers

[ ] EJMA : Standards of the Expansion Joint Manufacturers

Association

1. **DEVIATION FROM PURCHASER’S REQUIREMENTS**

Vendor’s proposal shall be in strict conformity with Purchaser’s requirements. Unless exceptions, deviations, or alternatives are clearly identified or listed in Vendor’s proposal, the requirements and conditions in this requisition shall be deemed to be accepted by Vendor.

1. **TEST & INSPECTION**

Inspection and tests shall be made by Vendor in accordance with;

[ x ] Requirements specified in Data Sheets and / or Project Specifications attached herein

[ x ] Vendor’s proposed procedure approved by Purchaser

[ x ] Source inspection plan/NDE plan included in Attachment #6

1. **PRICING STRUCTURE**

Vendor’s price in quotation shall be broken down as follows;

[ x ] Completed Equipment

[ x ] Unit Price per Tonnage for Equipment Body and Bundle

[ ] Unit Price per Tonnage for Platform & Ladder : to be quote as an optional

[ ] One(1) Years Operation Spare Parts (Optional)

[ ] Unit price of 1" through 24" nozzle for each rating and material including work

1. **ATTACHED DOCUMENTS**

The following documents shall form an integral part of this requisition.

| **Doc. No.** | **Rev. No.** | **Document Title** |
| --- | --- | --- |
| [ X ] **Data Sheets & Drawings** |  | (See ATTACHMENT # 1) |
|  |  | Per drawings from OCEAN-H System |
|  |  |  |
| [ ] **Engineering Drawings** |  |  |
|  | - |  |
|  |  |  |
| [ X ] **SK Standard Specifications** |  | (See ATTACHMENT # 3) |
| ESS-40100 | 1.5 | Welding, Heat treating and Non-Destructive Exam. |
|  |  | of Pressure Containing Equipment |
| ESS-40110 | 6.6 | Pressure Vessels |
| ESS-40210 | 8 | Shell and Tube Heat Exchangers |
| ESS-50260 | 2 | Requirements for Bolts, Nuts and Gaskets |
| ~~ESS-81111~~ | ~~7~~ | ~~Hot Service Insulation~~ |
| ~~ESS-81120~~ | ~~3.2~~ | ~~Fire Proofing~~ |
| ESS-82110 | 3 | Painting |
| ESS-90320 | 2 | Positive Material Identification |
| ~~ESS-90340~~ | ~~1~~ | ~~Impact Requirements for Materials~~ |
|  |  |  |
| [ ] **SK Standard Drawings** |  | (See ATTACHMENT # 3) |
| ~~ST-42001~~ | ~~1~~ | ~~Saddles for Heat Exchangers~~ |
| ~~ST-42002~~ | ~~2~~ | ~~Insulation Support Details for Heat Exchangers~~ |
| ~~ST-42004~~ | ~~1~~ | ~~Collar Bolt and Jack Bolt for Heat Exchanger~~ |
| ~~ST-42005~~ | ~~0~~ | ~~Seal Strip for Heat Exchanger~~ |
| ~~ST-42006~~ | ~~0~~ | ~~Impingement Baffle~~ |
| ~~ST-42008~~ | ~~0~~ | ~~Sliding Shoe for Heat Exchanger~~ |
| ~~ST-42009~~ | ~~0~~ | ~~Pulling Device for Heat Exchanger~~ |
| ~~ST-42010~~ | ~~0~~ | ~~Lifting Lug for Heat Exchanger~~ |
| ~~ST-43002~~ | ~~1~~ | ~~Minimum Spacing Distance Between Edges of~~ |
|  |  | ~~Welds~~ |
| ~~ST-43004~~ | ~~2~~ | ~~Construction Tolerances for Pressure Vessel~~ |
| ~~ST-43007~~ | ~~2~~ | ~~Attachments for Fireproofing on Vessel Skirts~~ |
| ~~ST-43008~~ | ~~1~~ | ~~Vessel Name Plate Bracket~~ |
| ~~ST-43010~~ | ~~1~~ | ~~Construction Details for Small Nozzles Pressure~~ |
|  |  | ~~Vessels~~ |
| ~~ST-43011~~ | ~~1~~ | ~~Typical Nozzle Detail~~ |
| ~~ST-43019~~ | ~~1~~ | ~~Ladder, Platform and Davit Clip Details~~ |
| ~~ST-43025~~ | ~~1~~ | ~~Grounding Connection Details~~ |
| ~~ST-43026~~ | ~~0~~ | ~~Standard Nozzle Length~~ |
| ~~ST-43027~~ | ~~0~~ | ~~Reinforcing Pad for Nozzle~~ |
| ~~ST-43029~~ | ~~0~~ | ~~Teflon Lined Sliding Plate~~ |
|  |  |  |
|  |  |  |
| [ X ] **Standard Formats** |  | (See ATTACHMENT # 5) |
| - | - | Clarification/ Exception/ Deviation List |
| - | - | Spare Parts List for Commissioning and Start-up |
| - | - | Spare Parts List for (1) Year Operation |
| - | - | Special Tool List |
|  |  |  |
| [ X ] **Others** |  | (See ATTACHMENT # 4) |
| ~~-~~ | ~~-~~ | ~~External Forces and Moments on Nozzles Tabulate~~ |
|  |  | ~~For Piping (#6-1)~~ |
| ~~PE-3100~~ | ~~1~~ | ~~Basic Engineering Design Data~~ |
| SIP-4003  SIP-4004 | 0  0 | NDE Plan for High Alloy  NDE Plan for Clad Material |
| SIP-4201 | 0.1 | Heat Exchanger (Shell and Tube) |
| - |  |  |
|  |  |  |

1. **VENDOR DATA REQUIREMENTS**

| **Doc.**  **Cat.** | **Description** | **Bid** | **For Approval** | | **For Final** | | **Data Book** | **Size** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Due** |  | **Due** |
| **A.** | **GENERAL** |  |  |  |  |  |  |  |
| A.1 | Vendor Document List & Schedule | X | X |  | X |  | X | A4 |
| A.2 | Sub-vendor List | X | X |  | X |  | X | A4 |
| A.3 | Manufacturing Schedule | X | X |  | X |  | X | A4 |
| A.4 | Organization Chart | X | X |  | X |  | X | A4 |
| A.5 | Progress Report | X | X |  | X |  | X | A4 |
| **B.** | **CONTROL DOCUMENTS** |  |  |  |  |  |  |  |
| B.1 | Contract Specific Inspection and Test Plan | X | X |  | X |  | X | A4 |
| B.2 | Welder Qualification Record and Welder list | X | X |  | X |  | X | A4 |
| B.3 | Quality Assurance Plan and Manual with  ISO 9001 certificate | X | X |  | X |  | X | A4 |
| **C.** | **ARRANGEMENTS** |  |  |  |  |  |  |  |
| C.1 | General Arrangement | X | X |  | X |  | X | A3 |
| C.2 | Foundation Requirements |  |  |  |  |  |  | A3 |
| C.3 | Erection Drawings |  |  |  |  |  |  | A3 |
| **D.** | **DATA SHEETS** |  |  |  |  |  |  |  |
| D.1 | Equipment Data Sheets/ Design Specifications | X | X |  | X |  | X | A4 |
| **E.** | **CALCULATIONS** |  |  |  |  |  |  |  |
| E.1 | Design / Code Calculation | X | X |  | X |  | X | A4 |
| E.2 | Local Stress Check by WRC | X | X |  | X |  | X | A4 |
| E.3 | Stress analysis by FEM |  |  |  |  |  |  | A4 |
| E.4 | Allowable Force and Moment | X | X |  | X |  | X | A4 |
| E.5 | Structural, Foundation & Support Calculation |  |  |  |  |  |  | A4 |
| **F.** | **DETAIL MECHANICAL DRAWINGS** |  |  |  |  |  |  |  |
| F.1 | Equipment Fabrication Detail Drawings | X | X |  | X |  | X | A3 |
| F.2 | Anchor/Setting Detail drawing |  |  |  |  |  |  | A3 |
| F.3 | Platform & Ladder Drawing |  |  |  |  |  |  | A3 |
| F.4 | Parts List / Bill of Material | X | X |  | X |  | X | A3 |
| F.5 | Insulation / Lining Detail |  |  |  |  |  |  | A3 |
| **G.** | **MANUFACTURING PROCEDURES** |  |  |  |  |  |  |  |
| G.1 | Weld Procedure (WPS & PQR) incl. Welding Map | X | X |  | X |  | X | A4 |
| G.2 | Fabrication Procedure | X | X |  | X |  | X | A4 |
| G.3 | Repair Welding Procedure | X | X |  | X |  | X | A4 |
| G.4 | Heat Treatment Procedure (Including PWHT) |  |  |  |  |  |  | A4 |
| G.5 | Rust Prevention Procedure |  |  |  |  |  |  | A4 |
| G.6 | Surface Preparation, Painting & Coating Procedure |  |  |  |  |  |  | A4 |
| **H.** | **TEST PROCEDURES** |  |  |  |  |  |  |  |
| H.1 | Hydrostatic / Pneumatic Test Procedures | X | X |  | X |  | X | A4 |
| H.2 | NDE(RT,UT,MT,PT, PMI or similar) Procedure | X | X |  | X |  | X | A4 |
| H.3 | PMI Procedure | X | X |  | X |  | X | A4 |
| H.4 | Hardness Test Procedure | X | X |  | X |  | X | A4 |
| H.5 | Impact Test Procedure | X | X |  | X |  | X | A4 |
| H.6 | Material Test Procedure | X | X |  | X |  | X | A4 |
| **I.** | **CERTIFICATION** |  |  |  |  |  |  |  |
| I.1 | Manufacturing Record Book Index | X |  |  | X |  | X | A4 |
| I.2 | Manufacturing Record Book | X |  |  | X |  | X | A4 |
| I.3 | Material Certificates | X |  |  | X |  | X | A4 |
| I.4 | Codes/Standard/Compliance Certificates | X |  |  | X |  | X | A4 |
| I.5 | NDE Results | X |  |  | X |  | X | A4 |
| I.6 | Test Results | X |  |  | X |  | X | A4 |
| I.7 | Heat Treatment Report and Chart | X |  |  | X |  | X | A4 |
| I.8 | Chloride Analysis of Hydro-test Water Certificate | X |  |  | X |  | X | A4 |
| I.9 | Painting Report |  |  |  |  |  |  | A4 |
| I.10 | Specification Waivers | X |  |  | X |  | X | A4 |
| I.11 | Inspection Release Note | X |  |  | X |  | X | A4 |
| **J.** | **HANDLING & SITE INSTALLATION** |  |  |  |  |  |  |  |
| J.1 | Documents Traveling with Goods | X | X |  | X |  | X | A4 |
| J.2 | Packing, Shipping, Preservation Handling & Storage Procedures | X | X |  | X |  | X | A4 |
| J.3 | Transportation Drawing | X | X |  | X |  | X | A4 |
| J.4 | Installation Instructions | X | X |  | X |  | X | A4 |
| J.5 | Net Weight, Gross Weight and Measurement | X | X |  | X |  | X | A3 |
| J.6 | Shipping Schedule and Packing List | X | X |  | X |  | X | A4 |
| **K.** | **OTHERS** |  |  |  |  |  |  |  |
| K.1 | Spare Part List - Commissioning |  |  |  |  |  |  | A4 |
| K.2 | Spare Part List – Two(2) year operation |  |  |  |  |  |  | A4 |
| K.3 | Special Tool List |  |  |  |  |  |  | A4 |
| K.4 | Clarification/Exception/Deviation List | X | X |  | X |  | X | A4 |

X: Required, C: Copies, EF: Electronic File, CD: Computer Disc, W: Weeks

**NOTES)**

Unless otherwise specified, Vendor drawing and/or document numbering shall be given as follow:

(12045D) – (Account Code No) – VD – (Item No) – (Doc. Cat.) – (Serial No)

* Account Code No. : 4 digits which shall be advised to vendor at KOM
* VD : It means Vendor Document.
* Item No. : Item no shall be shown without slash or dash. Ex) C-201A/B …C201AB
* Doc. Cat. : It comes from the first column of above table.
* Serial No. : It starts from 001 always whenever Document Categories are changed

Vendor shall submit documentation by uploading to the TDMS (SK Document System) and the drawing shall upload the original CAD file and PDF file which can be modified   
All documents and drawings shall be furnished and arrive at Purchaser’s office within the document schedule which are counted from Date of

( x ) Letter of Intention or ( ) Purchasing order.

Vendor document shall be prepared and submitted according to the Instruction for Vendor Documentation Preparation in attachment No. 3.

All vendor prints to be submitted shall be prepared using the following software.

1. Data sheets, lists and specifications : Microsoft Excel or Word
2. Drawings : AutoCAD or DXF files that can be converted to AutoCAD
3. If the above software is not applicable, scanned form is acceptable.

6. Vendor to propose outline fabrication procedure with his quotation.

1. **SPECIAL NOTES**
2. **General Requirements**

A. Priority

The order of precedence shall be as below.

1. Data Sheets
2. Special Notes in the Requisition
3. Licensor Standard Specification
4. SK Standard Specification
5. International Codes & Standards

B. Wind Load

1. Code : KDS
2. Basic Wind Speed : 34m/s

C. Earthquake Load

1. Code : KDS

D. All Shell and Tube Heat Exchangers shall be provided in accordance with the ASME Section VIII, Division 1 and ASME stamp is required. The manufacturer shall be the registered vendor in accordance with Korean High Pressure Gas Safety Control Law.

1. **Technical Requirement**
   1. All indicated thickness in the engineering drawing / data sheet shall be applied as minimum and, if specified minimum thickness have not enough strength as a result of detail strength calculation, vendor shall increase and verify all used thickness considering all design condition including wind / seismic condition.
   2. All tube material shall be seamless.
   3. Tube wall thickness specified in equipment data sheet is the minimum requirement.
   4. A corrosion allowance of 1.5mm shall be added to the exchanger support (i.e. skirts, lugs, saddles, etc.) thickness.
   5. All dimensions for the design shall be done in Metric system of units with the exception of pipe sizes and flange bolting diameters which will have the English system of measurement.
   6. All process nozzles & its reinforcement shall be designed to sustain the external forces and moments on nozzles of heat exchangers(Refer to the Attachment#6-4 in this MR). It shall be checked as per WRC107(or WRC297) and the basic stress intensity limits shall be as per ASME Sec.VIII Div.2 Appendix4. However, where the local stress check is out of range by WRC, the local stress should be evaluated by Finite Element Analysis or approved equivalent.
   7. Sliding bar for tube bundle maintenance shall be provided for removable type having bundle weight above 5450 kg as per API 660.
   8. Suitable lifting lugs shall be provided on each removal parts in order to facilitate handling
   9. Unless otherwise requested by purchaser, all supplied parts shall be shipped and tested with fully shop assembly condition.
   10. The fixed support shall be designed for bundle pulling load of full bundle weight
   11. Postweld heat treatment for tube-to-tubesheet weld joints shall normally confirm to the requirements for pressure retaining fillet welds, ASME Section VIII, Division 1.
   12. Nozzle orientation and elevation shown on the data sheets are preliminary. Purchaser will have the right to finalize them by fabrication drawing approval
   13. Vendor’s welding procedures shall be submitted to purchaser for review and approval prior to start of welding fabrication. A weld map for each vessel, and/or parts thereof shall be submitted with weld procedures locating and identifying each weld procedure number
   14. After pressure testing, shall be completely drained and cleaned.
   15. All openings for flanged connections and beveled ends shall be protected against corrosion and damage by applying suitable grease and blanking with bolted metal cover.
   16. All nozzles shall be Set-in type. Set-on type nozzles shall not be permitted.
   17. Slip-on type flanges shall not be permitted.
   18. The Flux Cored Arc Welding (FCAW) process in non pressure parts is used only.
   19. In the case of a heat exchanger, the strength calculation for the entire heat exchanger (Shell, Channel, etc.) at design time is included in the scope.
2. **Test and Inspection**
3. Vendor shall prepare Test and Inspection Procedures based on the applicable codes, standards and purchaser’s specifications referring to the type of inspection and details of test requirements.
4. Vendor shall perform the test and inspection as per the attached Source Inspection Plan (Attachment # 4) and Test and Inspection Procedure that developed by vendor and approved by Purchaser.
5. Vendor shall be responsible for arranging all types of inspection that are specified in the approved inspection plan and procedure. The Owner/Purchaser and their representatives reserve the right to attend at the inspection of any equipment or materials, and to visit a vendor’s or sub-vendor’s works at any time.

**ATTACHMENT #1**

**DATA SHEET**

**ATTACHMENT #2**

**ENGINEERING DRAWINGS**

**(Later)**

**ATTACHMENT #3**

**SK STANDARD SPECIFICATIONS & DRAWINGS**

**ATTACHMENT #4**

**SOURCE INSPECTION PLAN**

**ATTATCHMENT #5**

**STANDARD FORMATS**

|  |  |
| --- | --- |
| NO. | DESCRIPTION |
| 1 | SPARE PARTS LIST FOR CONSTRUCTION AND COMMISSIONING |
| 2 | SPARE PARTS LIST FOR ONE-YEAR OPERATION |
| 3 | SPECIAL TOOL LIST |
| 4 | CLARIFICATION/EXCEPTION/DEVIATION LIST |

|  |  |
| --- | --- |
| **SPARE PARTS LIST**  **FOR**  **CONSTRUCTION AND COMMISSIONING** | PROJECT NO. :  RFQ NO. :  MFR’R : |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ITEM NO. | NAME OF PARTS | DRAWING NO. | QUANTITY (UNIT) | | SPEC.  (MATERIAL) | SKETCH  (MANUFACTURER’S NAME) | NET WT. (Kg/PC) | REMARKS |
| PARTS NO. | INSTALLAED PER ONE SET | RECOMMENDED QUANTITY | PIECE |
|  |  |  |  |  |  |  |  |  |

|  |  |
| --- | --- |
| **SPARE PARTS LIST**  **FOR**  **ONE(1) YEAR OPERATION** | PROJECT NO. :  RFQ NO. :  MFR’R : |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ITEM NO. | NAME OF PARTS | DRAWING NO. | QUANTITY (UNIT) | | SPEC.  (MATERIAL) | SKETCH  (MANUFACTURER’S NAME) | NET WT. (Kg/PC) | REMARKS |
| PARTS NO. | INSTALLAED PER ONE SET | RECOMMENDED QUANTITY | PIECE |
|  |  |  |  |  |  |  |  |  |

