GENERAL REQUIREMENTS - SMALL FORGINGS

1. SCOPE

1.1 This Process Specification provides the Engineering Requirements for all forgings for stationary and rotating gas turbine, steam turbine and generator components other than those included in GT10621 (Rotor, Shaft and Field Forgings), GT10622 (Generator Retaining Rings) and GT10623 (Turbine Wheel, Coupling, Bull Gear and Stub Shaft Forgings).

1.2 Suppliers are responsible for meeting the requirements of this specification and the other requirements set forth in the applicable Forging Drawing, Material Specification and/or Process Specification. This responsibility also applies to the prime Suppliers for any or all operations performed by Sub-Suppliers.

1.2.1 The quality requirements contained in the Part Drawing, the Part Process Specification, the Material Specification and this General Process Specification apply to forgings as-finished processed by the forging Supplier and also after any subsequent operations performed by BHEL such as machining. The Purchaser has the right to reject any shipped forging that fails to comply with Part Drawing or Specification requirements during in-house material acceptance testing and/or inspection.

1.3 In the event of conflict between the various Purchase Order Documents, the general order of precedence is as follows:

Part Drawing
Part Specification
Material Specification
General Requirement Specification

1.4 Communication

1.4.1 External Supplier (See Definition)

1.4.1.1 BHEL Gas Turbine Purchase dept. is the authorized interface for all communication between BHEL and the External Supplier. All questions or requests for additional information shall be submitted to Purchase dept for clarification. Conflicts between applicable specification and/or drawings shall be submitted to Purchase dept for resolution by Engineering.

1.4.2 Internal Supplier (See Definition)

1.4.2.1 All communication, including questions or requests for additional information, shall be submitted to GT Engineering

1.5 Requests For Deviations - Requests for deviations to the requirements of this specification shall be submitted as follows:

1.5.1 External Supplier - To Purchase dept NCR (Non conformance report)

1.5.2 Internal Supplier - To the appropriate Engineering personnel by NCR

2. APPLICABLE DOCUMENTS

2.1 The following documents shall form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue shall apply.

2.1.1 General Electric Company

GT10610	Visible Dye Penetrant Testing
GT10615	Sampling Requirements for Approved Prime Suppliers
GT10184	Ultrasonic Testing of Low Alloy Gas Turbine Forgings
GT10616	Magnetic Particle Inspection Methods for Steam Turbine and Generator Components
GT10617	Fluorescent and Visible Penetrant Inspection Method
GT10618	Magnetic Particle Test and Liquid Penetrant Acceptance Standards for Stationary Turbine Components
GT10614	Ultrasonic Testing of Forged and Wrought Parts
GT10619	Ultrasonic Testing of Single and Double Forged Machined Nozzle Boxes and Nozzle Box Fillets
GT10222	Heat Treat Process Control
GT10620	Supplier Quality Requirements

2.1.2 American Society for Testing and Materials

A370	Standard Methods and Definitions for Mechanical Testing of Steel Products
A788	Standard Specification for Steel Forgings, General Requirements
E29	Standard Recommended Practice for Indicating Which Places of Figures Are to Be Considered Significant in Specified Limiting Values
E45	Standard Practice for Determining the Inclusion Content of Steel

E350	Standard Methods for Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron and Wrought Iron
E353	Method for Chemical Analysis of Stainless Heat Resisting, Maraging and Other Similar Chromium - Nickel - Iron -Alloys
E380	Standard for Metric Practice

3. DEFINITIONS

3.1 Personnel

3.1.1 Purchaser - BHEL Purchase dept.

3.1.2 External Supplier - The corporation, company, partnership, sole proprietorship or individual engaged to perform the process covered by this Specification.

3.1.3 Internal Supplier - Any BHEL Manufacturing Department.

3.1.4 Supplier - As used herein, unless specifically designated, refers to either an External or an Internal Supplier.

3.2 Specification Deviation Documents

3.2.1 Applicable to External Supplier

3.2.1.1 Non conformance report (NCR) - A method for the documentation, approval and control of a waiver for materials, processes, or dimensions which deviate from Purchase Order documents (drawings, specifications, engineering instructions, etc.).

3.2.2 Applicable to Internal Supplier

3.2.2.1 Non conformance report (NCR) - BHEL Manufacturing Department non-conformance report initiated during processing through the factory. Used by Manufacturing to document non-conformance to governing documents and request corrective action.

3.3 Documentation

3.3.1 Manufacturing Process Plan (MPP) - A BHEL -approved, detailed, step-by-step list of operations by which the parts are planned to be processed, tested and inspected.

3.3.2 Qualification Package - First Piece Qualification documentation containing the results of the tests and inspections performed on the First Piece as required for qualification.

3.3.3 Frozen Process Plan - A Purchaser approved forging supplier processing/manufacturing plan which has been successfully used to demonstrate the capability to consistently produce the specified part with all of the application required mechanical properties and material qualities/characteristics. Once approved, the Frozen Process MPP shall not be changed without the consultation with the Purchaser plus the submission and approval of a new supplier MPP.

3.3.3 General Process Specification - A process specification which covers the requirements for an entire class of parts, such as turbine/generator forgings.

3.3.4 Part Specification - A process specification which covers extra requirements for a specific part, such as ring forgings for gas turbine bucket shrouds.

3.3.5 Material Acceptance Certificate (MAC) - A summary of the chemical, mechanical and non-destructive test qualities of a forging set forth in a format which is peculiar to and integral with each Material Specification.

3.4 Technical Terms

3.4.1 Transition Temperature - That temperature at which the cleavage or granular fracture is equal to fifty (50) percent of the original cross sectional area

4. QUALIFICATION REQUIREMENTS

4.1 A comprehensive evaluation for First Piece Qualification (FPQ) shall be required of a new Supplier, or when there is a significant change in the approved MPP or if a Supplier has not performed this process within the two years prior to Purchase Order placement.

4.2 FPQ shall, as a minimum, include the following:

4.2.1 An MPP approved by Material engg section prior to initiation of the FPQ.

4.2.2 Non-destructive test data.

4.2.3 Certificate of Conformance

4.2.4 Qualification Samples - FPQ samples shall be provided as requested.

4.3 Qualification Package - The Supplier shall submit two (2) copies of the FPQ documentation for review/approval.

4.4 Upon receipt of written notification for FPQ, the Supplier is approved for production of the qualified part. The MPP shall be "FROZEN", not to be changed without approval of a new MPP.

4.5 If the Supplier has made a similar forging for BHEL, Materials Engineering shall review the original qualification work performed by the Supplier and modify the First Piece Qualification requirements accordingly.

4.6 **NOTE**: The Prime Supplier is required to document and submit all First Piece Qualification data required by this specification for the work that any Sub-Supplier(s) are supplying.

4.7 **NOTE**: All Suppliers using the services of a Sub-Supplier in any of the following areas of manufacturing must obtain approval from Materials Engineering, prior to performing any of said operations:

- Raw ingot/billet material source
- Forging
- Heat treating
- Mechanical property testing
- Machining
- Non-destructive testing

5. PRODUCTION PROCESS REQUIREMENTS

5.1 Responsibility - It shall be the responsibility of the Supplier to understand thoroughly the work scope and all documentation needed to complete the work. This responsibility shall apply to the prime Supplier for any or all operations performed by sub-tier Supplier(s).

5.2 General - The forging shall be manufactured in accordance with a documented frozen MPP which has been reviewed and approved by the Purchaser except in areas which are considered proprietary. In such cases, the review by the Purchaser shall be limited to objective evidence of the existence and documentation of the instructions. The MPP shall be identified by the Supplier and such identity shown on the Certification. The Supplier shall monitor the actual process, compare the process to the MPP and report to the Purchaser any variances using the NCR. The Purchaser reserves the right to periodically audit the Supplier's facilities and practices used in the processing and testing of the forging. Such reviews and audits shall not relieve the Supplier from the responsibility of producing a suitable forging.

5.3 The MPP shall include as a minimum, the following information:

5.3.1 Applicable Drawing number(s) and Var number(s).

5.3.2 Applicable Part Process Specification, General Process Specification Non-destructive Test Specification(s) and Material Specification(s).

5.3.3 Ingot/billet manufacture, melt practice, pouring practice, forging practice including information on ingot discard.

5.3.4 Ingot/billet incoming material acceptance procedure(s) and material inventory control system.

5.3.5 A brief description, in chronological order, of each operation used in the manufacture of the forging. The in-process and final inspection operations associated with the various manufacturing operations shall be included in the MPP.

5.3.6 Identification of Sub-Supplier(s), including names and addresses.

5.3.7 Description of the identification marking system used for finished parts.

5.3.8 Description of the information and data that will appear on the Certificate of Test.

5.4 Raw Material - Ingot/billet material shall only be obtained from sources approved by BHEL Materials engg section.

5.5 Discard - Sufficient discard shall be made from each ingot to assure freedom from piping and undue chemical and non-metallic segregation.

5.6 Hot Work - Ingot shall be worked with a press of sufficient power to completely work the cross-section and the total work must be adequate to assure that the heat treatment will develop a refined structure with good ultrasonic penetrability and quality plus good levels and uniformity of mechanical properties.

5.6.1 Forged Multiples - Individual ring forgings may be produced in multiples, such that the same, or similar BHEL components are forged from one contiguous sleeve. The quality requirements of Para 5.6 shall apply.

5.7 Rough Machining - At the option of the Supplier, forgings may be rough machined prior to final heat treatment for mechanical properties to the configuration set forth in the approved Process Plan. If rough machined, sufficient cover stock should be left on forging surfaces after rough machine turning as allowance for final heat treating scale losses (including stock for possible re-heat treatment) and finish machining operations. This supplier cover stock plus the normal BHEL specified 3mm cover on forging drawings results in a minimum cover of 12.5 mm

5.8 Heat Treatment - The heat treatment shall be in accordance with the requirements of the applicable Part Process Specification and the Material Specification. More than one complete re-heat treatment will not be allowed.

5.8.1 Heat Treat Records - The heat treat furnace and thermocouple records, properly identified relative to purchase order and forging serial numbers, shall be retained by the Supplier for a period of at least five (5) years from the forging ship date.

5.8.2 Heat Treatment of Forged Multiples - When ring forgings are produced as multiples in a sleeve arrangement, the heat treatment (including quenching) may be applied to the forged multiple as one contiguous piece of material.

5.9 Finish Machining

5.9.1 Surface finish requirements, reference to Para. 6.9.

5.10 Tests and Inspections - The Supplier shall test and inspect the forging as specified by the Part Drawing, the Part Process Specification and the Material Specification, unless an alternate plan is approved as part of the MPP.

5.10.1 Testing of Forged Multiples - MPPs will be considered for approval that incorporate sampling plans differing from the applicable Part Drawing, Part Process Specifications and/or Material Specification. Sampling plans with a reduced amount of mechanical property testing may be proposed by the Supplier to take advantage of a multiple forging configuration.

5.10.1.1 Test specimen(s) must be taken from the forged piece and not simply generically from the ingot from which the forging was obtained.

5.10.1.2 Such a multiple-part forging shall have a cylindrical cross section with the same nominal OD (outer diameter) and ID (inner diameter) as the specified part and shall not exceed 1 meter in total axial length including material for testing.

5.10.1.3 Testing requirements per material specification and drawing shall apply only to the single forging, prior to removal of the parts, with the exception of hardness requirements which shall also apply to the individual parts.

5.10.1.4 For the purpose of tensile testing location, two diametrically opposite Brinell hardness measurements shall be made at each end of the cylindrical forging. Tensile test specimen(s) and any other required test specimen(s) shall be taken from a location in nearest practical proximity to the lowest measured hardness.

5.10.1.5 Measure the Brinell hardness of each individual part after separation from the forging. Make two diametrically opposite measurements at one end of the part at a point midway between the ID and OD.

5.11 Marking & Shipping: Each forging or part thereof, shall be legibly marked by stenciling,stamping with steel figures, or throughthe use of "paint sticks"with the information listed below.When painted or stenciled, the marking product shall be a bright color(white,yellow, orange)capable of withstanding outdoor exposure for extended periods of time.

5.11.1 BHEL purchase order number including item number.

5.11.2 BHEL serial number (if required).

5.11.3 BHEL forging drawing number, Var number and revision number or letter, if applicable.

5.11.4 BHEL specification number.

5.11.5 BHEL assigned vendor.

5.11.6 Manufacturer's serial or identifying number.

5.11.7 Non-conformance report (NCR) number, if an approved NCR applies to the forging In addition to stamping the NCR number on the forging, the letters NCR should be prominently marked on the forging with yellow paint.

5.11.8 Each part removed from a multiple forging configuration shall be clearly identified at one end with the serial or identifying number of the forging, plus a sequence number (-1, -2, etc.).

6. INSPECTION/TEST PROCEDURES AND REQUIREMENTS

6.1 FPQ Parts

6.1.1 Perform the tests and inspection specified by the Part Drawing, the Part Process Specification, the Material Specification and any special written instruction by Material engineering section and/or QA dept.

6.2 Production Parts

6.2.1 Perform the tests and inspection specified by the Part Drawing, the Part Process Specification and the Material Specification.

6.3 Chemical Composition

6.3.1 Heat (Ladle) Analysis - An analysis of each heat shall be made by the manufacturer to determine the percentage of the elements specified under Chemical Composition as set forth in the applicable Material Specification. The analysis shall be made on a suitable sample obtained just prior to pouring of the heat and shall conform to the requirements of the applicable Material Specification.

6.3.2 Multiple Heat Analysis - When more than one heat is used to produce a single ingot, the analysis of each heat and a weighted average analysis (Ref. ASTM-A788) of the heats shall be reported. The chemical composition of each heat, with the exception of the carbon content, shall conform to the requirements of the applicable Material Specification. The weighted average for the carbon content, all heats combined, shall conform to the requirement of the applicable Material Specification.

6.3.3 Re-Melt Heat Analysis - When consumable re-melting processes (Electro-slag-remelt or Vacuum arc remelt) are used for final melting, an analysis shall be made on samples taken from the top and bottom of the ingot, billet or forging, at the option of the manufacturer. The analyses shall conform to the requirements of the applicable Materials Specification.

6.3.3.1 When electrodes from different master heats are re-melted sequentially, an analysis shall be made on each zone of the re-melted ingot corresponding to proportions of each a respective heat. The chemical analysis of each zone shall conform to the requirements of the applicable Material Specification.

6.3.4 Deviations from the Chemical Composition set forth in the applicable Materials Specification, as determined from the process or the forged product, may be allowed if an evaluation by the Purchaser of the mechanical properties and the qualities of the forging indicates that the forging is suitable for the intended application.

6.3.5 The Chemical Composition as determined by the Heat Analysis or Re-Melt Heat Analysis (as applicable) shall be reported in the Certification, herein required.

6.3.5.1 **NOTE**: For purposes of determining conformance to the Chemical Composition, as set forth in each applicable Material Specification, all specified limits are absolute limits as defined in ASTM E-29.

6.4 Hardness Test - When required by the applicable Material Specification, Forging Drawing, and/or Part Specification, forgings shall be hardness tested using Brinell Hardness Testing Methods, or other methods which have been approved by Materials Engineering.

6.5 Magnetic Particle Test - When specifically required by the Material Specification, Forging Drawing or Part Specification, the supplier shall perform a magnetic particle test in accordance with BHEL Specification GT10616 The test shall be evaluated in accordance with appropriate process specification.

6.6 Ultrasonic Test - When specifically required by the Material Specification, Forging Drawing or Part Specification, the supplier shall perform an ultrasonic test. Forgings containing ultrasonic indications in excess of the limitations set forth in the applicable specification shall be referred to the Purchaser, by NCR (Ref. Para. 6.10) for disposition, prior to further processing.

6.6.1 Multiple Forging Configuration - It is only required that the full multiple piece forging be ultrasonically tested prior to the separation of any of the smaller pieces. It is not necessary to ultrasonically test the individual separated forgings unless a special request is made.

6.7 Mechanical Tests

6.7.1 General - Forgings with mechanical properties under or over the requirements of the applicable Material Specification shall be referred to the Purchaser, by NCR (Ref. Para. 6.10), for review and disposition relative to the suitability of the forging for the intended application. If the balance of mechanical properties make the forging suitable for its intended application, it shall be accepted. If any of the properties are outside the specified property limits and the overall mechanical property balance is unsatisfactory, then the forging will be rejected on the Supplier and the Purchaser is not liable.

6.7.1.1 All final mechanical tests shall be performed by an approved testing source using test procedures in accordance with ASTM-A370 on test specimen removed from the respective forging after the final heat treatment. If a subsequent stress relief anneal is performed at a temperature less than 28 °c below the final tempering cycle, the final mechanical tests shall be performed for this heat treat condition. The requirements for mechanical tests including type, location, quantity and limits shall be set forth in the applicable Material Specification.

6.7.2 Tensile Tests - Unless otherwise set forth in the Material Specification, tensile test specimens shall be taken in the tangential direction relative to the primary axis of the forging.

6.7.3 Charpy V-Notch Impact Tests - Test specimens shall have 45-degree V-notch in accordance with ASTM-A370. The root of the notch shall be parallel to the primary axis of the forging with the notch opening directed at the outside diameter (periphery) of the forging.

6.7.4 FATT - When required, FATT shall be estimated from the curve obtained from at least four specimens, tested at different temperatures. About half of the specimens should have percentages of cleavage or granular fracture above the 50 percent level and about half below.

6.7.5 Re-Tests

6.7.5.1 If a tensile specimen exhibits tensile or yield strengths that are below the specified values due to an error in testing procedure, one adjacent re-test may be performed.

6.7.5.2 If the lower than specified tensile test result was not caused by an error in testing procedure and was not caused by any unusual condition, such as rupture, flakes, or cracks in the steel, two adjacent specimens must be tested without a re-heat treatment.

6.7.5.3 If a Charpy V-Notch specimen exhibits a value below the minimum specified energy and this value is not less than two-thirds of the minimum specified, re-testing is permitted. Re-testing will be three additional Charpy V-Notch tests from a location adjacent to and on either side of the specimen that failed. Each of these test results must meet the minimum specified energy value. Re-testing is not permitted when the measured energy value is below two-thirds of the minimum specified value unless variances in the specimen preparation or the test procedure cause the test to be invalidated.

6.7.5.4 All re-test results must meet the requirements of the applicable Material Specification.

6.7.6 Test Results - The results of all mechanical tests performed after the final heat treatment shall be reported in the Certification required by this specification. All re-tests must be suitably identified.

6.7.6.1 For purposes of determination of conformance to the Mechanical Requirements, as set forth by the applicable Material Specification, an observed or calculated value shall be rounded off to the nearest integer value in N/mm for tensile and yield strengths and to the nearest one (1) percent for the elongation and reduction of area, in accordance with the round-off method of ASTM-E29.

6.8 Photomicrograph - When specifically required by the material specification or other applicable document the supplier shall submit to the Purchaser, in the Certification, photomicrographs (100X magnification), as follows:

6.8.1 Microstructure - As etched in accordance with the requirements of the applicable Material Specification.

6.8.2 Cleanliness - Typical worst field condition based on a cleanliness rating on specimens with the polished surface on a radial plane parallel to the primary axis of the forging. The cleanliness rating shall be performed in accordance with ASTM E-45, JK Chart, Method A, direct comparison method, worst field rating; Level 3 maximum allowed.

6.8.3 Photomicrograph Locations

6.8.3.1 The photomicrographs shall be taken from a portion of a broken test specimen from each test location.

6.9 Dimensions and Tolerances - Forgings shall be furnished in accordance with the drawing accompanying the purchase order, with a surface finish satisfactory for ultrasonic examination. The finish shall be tear-free and shall have no surface waviness in excess of 0.13 mm in any 50 mm area for phonograph type finishes and 0.025 mm for broad nose finishes. Surface finish roughness not exceeding 250 RMS is considered suitable for periphery ultrasonic testing.

6.10 Deviation Requests - The supplier may request deviations to a Part Drawing, Material Specification or Process Specification requirement(s) by means of a Non conformance report (NCR).

6.10.1 NCRs must include all of the applicable information available which would be required by the Purchaser for prompt disposition. Additionally, all NCRs must contain information relative the supplier corrective action to be taken to prevent future deviation conditions from occurring.

6.10.2 NCRs shall be submitted through Purchase dept for disposition by Materials engg and/or Design Engineering.

6.10.3 NCRs which have been approved by the Purchaser for deviation must become a part of the records for all parts involved. NCRs which have been approved by the Purchaser shall be attached to the required Certificates of Test.

6.11 Purchaser Testing - The Purchaser reserves the right to pick a forging at random from a production run and perform the FPQ evaluations. Failure to pass any of the FPQ requirements shall be cause for the review and possible rejection by the Purchaser of all suspect forgings. Any such rejection shall require re-qualification by the Supplier.

6.11.1 Non-destructive testing techniques such as ultrasonic inspection, magnetic particle, liquid penetrant, etching and others shall be used to determine the forging soundness.

6.11.1.1 A magnetic particle test may be performed by the Purchaser, or duly appointed representative, after all finish machining has been completed. Magnetic particle indications found during this test can be cause for rejection of the forging.

6.11.1.2 Interpretative techniques, such as fracture mechanics, may be used to evaluate the non-destructive test data.

6.12.2 Purchaser Product Check Analysis - A chemical analysis may be made by the Purchaser on specimens machined from the surface of any forging. The forging will be acceptable if the chemical composition, thus determined for all elements except carbon, sulfur, and phosphorous, conforms to the specification requirements within the permissible variations outlined in ASTM Specification A788. The elements carbon, sulphur, and phosphorous shall check within the following checking limits:

Carbon	±	0.03%
Phosphorus	±	0.003%
Sulphur	±	0.003%

6.12.2.1 Referee Methods - Unless otherwise set forth in the Forging Drawing, Material Specification, this Specification or Part Specification, the following will be applicable as Referee Methods. Unless otherwise specified, the latest issue shall apply.

Chemical composition ---------- ASTM E 350
- or ASTM A 788
Hardness test ---------- ASTM A 370
Impact test ----------ASTM A 370
Inclusion content ----------ASTM E 45
Metric conversions ----------ASTM E 380
Tensile test ----------ASTM A 370

6.13 Certificate of Test

6.13.1 Internal Supplier - Shall promptly submit the Certificate of Test to Manufacturing Quality Assurance.

6.13.2 External Supplier - Shall submit the Certificate of Test to the Purchaser address shown on the Purchase Order.

6.13.3 A Certificate of Test shall be submitted for each component stating the component was processed in accordance with the requirement of this Specification and other applicable documents. The Certificate shall be signed and dated by an authorized Supplier Representative and shall, as a minimum, include the following information.

6.14 Certification - The Supplier, after performing all of the required testing, shall promptly report the results to the Purchaser on a Certificate of Test. All of the forgings represented by a given Certificate of Test shall have the same drawing number, same heat number and be from the same heat treat lot. The Certificate of Test shall include the following:

6.14.1 Supplier name and address.

6.14.2 Supplier vendor code.

6.14.3 Date.

6.14.4 BHEL purchase order number.

6.14.5 Supplier order number.

6.14.6 Material specification number, revision number, and material grade.

6.14.7 Part Process Specification identification number, revision level and revision date (if a part Process Specification exists).

6.14.8 General Process Specification identification number GT10613 , revision level and revision date.

6.14.9 Supplier Process Plan identification number, revision level and revision date.

6.14.10 BHEL forging drawing number, Var number and revision number or letter if applicable.

6.14.11 BHEL serial number (if required on order).

6.14.12 Mill heat number and heat chemical analysis of elements specified in the Material Specification. Material source if the supplier is not the basic producer of the steel.

6.14.13 Results of all tests and inspections required by the Materials Specification and other applicable documents.

6.14.14 Record of heat treatments (hold temperatures, times at temperature and manner of cooling.

6.14.15 Attachments (when applicable)

- Ultrasonic Test Report(s)
- Magnetic Particle Test Report(s)
- Applicable NCRs
- Photomicrographs(s)
- Test Location Sketch

6.14.16 The Supplier shall prepare copies of the certification package and send them to the Purchaser as specified in the purchase order.

6.14.17 **NOTE:** When specifically required by the Material Specification or other applicable document, a Materials Acceptance Certificate (MAC) shall be used as the cover sheet for the Certification package to report a summary of the chemical, mechanical and non-destructive test qualities of the forging.

7. NOTES

7.1 The application of this specification shall make null and void any prior agreement, understanding or documentation which violates the requirements set forth in this specification.

TD-106 3
Rev. 5
Form No.

PRODUCT STANDARD

HYDERABAD

PROD STD : GT10613
REV. NO. 01
PAGE 15 OF 15

RECORD OF REVISIONS

Rev. No.	Date	Revision Details	Revised	Approved
00	31-03-99	first made	—	—
01	31.7.21	Revised as per latest spec, Rev"E"	CNK	KDG

Ref. Doc.
P44-AL-0202 Rev.P