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GAS TURBINE SPECIFICATION

FOR

VENDOR SUPPLIED

TECHNICAL DOCUMENTATION

(O&M manuals for End User)

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Ref. Doc

Title: Equipment Service Manuals

Purpose:

To Furnish BHEL Hyderabad with necessary operation and instruction information for manufactured or vendor supplied systems, equipment assemblies or equipment components. Technical documentation furnished will contain all information necessary for the supply of complete operating and maintenance instructions by Company to its users.

This specification outlines information requirements, document format and quality standard and includes exhibits for use by supplies in complying with Company requirements.

FINAL DOCUMENTATION:
These documents should be supplied in Hard and soft copies as mentioned below:

a) Hard copies of 20 sets of Equipment Service Manuals.
b) Soft copies in PDF format in a single file in 2 sets of CDS.

Information Requirements

1.1 General

The Company requires certain technical documents to assist the user in the operation, maintenance, engineering, administration and management of the equipment after it is placed in commercial operation. The supplier shall provide the required technical documents including, but not limited to those listed below, in the form and content specified by the Company's standards contained herein. In the event the Company has not completely specified all the requirements for the documents, the supplier shall furnish the information in the form and content consistent with generally accepted industry practices.
In every case, supplier shall furnish all information necessary for proper operation and maintenances of equipment and personnel safety.

Note: Where technical documentation furnished by supplier includes information prepared by supplier's subcontractor(s), supplier will assure such information meets the requirements of these specifications.

1.2 Form

The form of technical documentation to be furnished by the supplier may vary from standard equipment publication for a single component (e.g. solenoid valve; fractional HP motor; pressure switch) to comprehensive technical manual for major equipment assemblies or system (e.g. fuel treatment system; outdoor unit substation; turbine starting system; etc.)

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1.2.1 Definitions---- For purposes of this specification the following definitions are applicable:

a) *Equipment Publication*---A standard, generally pre-printed product information document including but not limited to photographs and illustrations, dimensional data, operating parameter/ratings, and instructions for installation, operation, maintenance and safety.

b) *Technical Manual* --- A composite publication containing a comprehensive description of equipment or systems with instruction for effective use, including but not limited to the following sections as required: instructions covering initial preparation for use; operational instruction; maintenance instruction; troubleshooting procedures and safety precautions.

1.3 Scope

Publication will contain all information necessary to facilitate the user understanding of equipment and it's function(s) and will included the following specific information (except where obviously not applicable):

1.3.1 Complete description of equipment including installation procedure.
1.3.2 Equipment operating parameters (e.g. horsepower, rpm, pressure, flow, etc)
1.3.3 Comprehensive operating instructions.
1.3.4 Preventive maintenance procedures.
1.3.5 Trouble shooting procedures.
1.3.6 Disassembly and reassembly instructions.
1.3.7 Lubrication requirements
1.3.8 Inspection procedures.
1.3.9 Safety precautions and instructions
1.3.10 Special tools
1.3.11 Storage guide – For short-term periods (upto 6 months) and for long term periods (6 months or longer)
1.3.12 Part lists and recommended spares (see Paragraph 2.9)
1.3.13 Reference drawings- to support description, operation, maintenance and troubleshooting. Such drawings will include but not be limited to:
a) Schematic piping diagrams.
b) Equipment outline & General Arrangement drawings and clearance diagrams.
c) Alignment diagrams and instructions
d) Electrical schematic diagrams
e) Instrumentation and control diagrams.

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2.0 Information To Be Supplied

2.1 Operational checkout:

Information shall be provided for complete operation checkout of the system or equipment. Instruction shall include step-by-step procedure and identification of approved equipment necessary to insure that a system or component meets acceptable operation performance standards. Test values and permissible tolerances shall be provided. Adjustments required during operational checkout such as regulating system or component gain or signal level shall be appropriately outline.

2.2 Operating instructions

Supplier will furnish adequate operating instruction for the equipment covering a complete start to stop cycle including safety precautions to be observed.

Subjects to be treated shall include the following as may be applicable:

2.2.1 Preliminary adjustment, alignment, positioning, and warm-up procedure including preventive maintenance or major maintenance or minor maintenance such as lubrication cleaning etc. to be accomplished by personnel operating the equipment

2.2.2 Means of connection between equipment and equipment being tested, maintained, handled, processed etc.

2.2.3 Purpose and use of all operating controls and auxiliary equipment, or attachments furnished with the equipment.

2.2.4 How to start and stop the equipment.

2.2.5 Operation of the equipment in normal sequence of operation.

2.2.6 Operation of the equipment under emergency conditions.

2.2.7 Purpose, use and interpretation of readings of all indicating instruments.

A list of all controls and indicators and an explanation of the function of each shall be given. When applicable, typical instrument readings (with acceptable upper and lower limits stated) and indicator presentation to inform the operator what recognizable results should be expected shall be provided. This shall include information such as:

a) Sequence or series of proper scope waveforms or instrument reads during operation.

b) Typical instrument reading and indicator presentation for various uses of the equipment

c) Indicator lights, scope and waveforms and instrument reading illustrating proper and improper functions.

2.2.8 Means of self-testing the equipment when purposely built-in-test feature of self test capability in provided.

2.3 Warnings, Cautions & Notes

Where important or critical operating or maintenance data is included in the technical documentation, such information shall be highlighted and presented in the appropriately conspicuous manner in the text **Warnings, Cautions and Notes**.

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Warnings, Cautions and Notes shall be specified according to the following definitions:

Warning: An operating or maintenance procedure, practice, condition, statement, etc which if not strictly observed could result in injury to or death of personnel.

Cautions: An operating or maintenance procedure, practice, condition, statement, etc which if not strictly observed could result in damage to or destruction of equipment.

Note: An essential operating or maintenance procedure, condition, or statement, which must be highlighted

2.4 Maintenance and Replacement Instructions

Comprehensive instruction shall be provided for necessary maintenance operations to keep the equipment in a completely satisfactory condition. Repair methods shall also be specified for the correction of deficiencies and conditions considered repairable within the scope of the level of maintenance to which the manual applies. Specific data shall be provided to adequately describe acceptable repairs including materials specification. Application and operation of specific tools and test equipment shall be described, as they are required in maintenance and replacement operations. For non-repairable equipment or equipment which contains non-repairable components, repair instruction will normally be limited to the removal and replacement of the individual components (and alignment where applicable) or the complete equipment assembly. For equipment, which contains repairable components, instructions all cover any of the following procedures but not only limited to, which are applicable to the equipment.

(a)Disassembly (b) Cleaning (c) Inspection (d) Repair or Replacement (e)Tolerance Limits (f)Assembly (f)Alignment

2.5 Troubleshooting Information

Information concerning the indication of trouble, determination of its cause and the necessary ready for all troubles, which may be encountered, shall be included. For most equipment a troubleshooting guide with column headings “Trouble”, “Probable Cause” and “Remedy” which may supplemented by test point schematics or block diagrams shall be supplied. For electronic equipment a more detailed trouble analysis chart should provided.

2.6 Testing Instructions

Tests to be performed after maintenance, repair or replacement of the components for the purpose of checking for satisfactory operation of the complete equipment shall be described. Operating instruction sufficient for the test purposes shall included. Test values and acceptable tolerances shall be given for failure of the equipment to meet the necessary tests.

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2.7 Reference Drawings

The supplier should furnish reference drawings as mentioned in Sec 1.3.13:

Where the equipment's nature, relative complexity and number of components make it practicable, a single schematic diagram shall be prepared to cover all signal circuits, power circuits and control circuits. When a single schematic is impractical, a separate diagram shall be prepared for each component. When the equipment receives information from or provides information to other components of system schematic diagrams shall be provided showing all required interconnections.

2.8 Technical Data

Certified technical data in the form of drawings or tables will include the following information

2.8.1 Operating parameters of equipment such as motor horsepower, rpm, etc

2.8.2 Equipment lubrication and cooling requirement as applicable.

The following technical data will be furnished as a separate documentation package and only when specifically requested by the Company:

2.8.3 Filled in data sheets from technical specifications.

2.8.4 Certified performance curves of pumps, motors, fans, etc.

2.9 Parts List and Recommended Spares

In all cases a complete parts list must be provided as a separate package even though such information may have already been included on drawing or in equipment publications as an integral part of operation and / or maintenance instructions.

The parts list will clearly identify each component and include all the information like:

(a) Part name/description, (b) Manufacturer part number of catalog number, (c) Quantity of each part used per component (d) Drawing identification number(s), (e)Raw material form and size (f)Recommended quantify of spares for stocking (f)Special ordering information.

3.0 Document Specification

Supplier shall furnish technical documentation in accordance with the following requirements:

3.1 Standard Page Format

A4 size (210mmX297mm) sheets with 170mmX267mm maximum image area. Left-hand binding margin shall be 25mm **and punched with** f **8mm punch for insertion into standard four (28.5/80/80/80/28.5 mm pitch) post binders (Spiral binding / Comb binding is not acceptable under any circumstances)** – Top and bottom margins shall be 15 mm: right hand margin shall be 15mm.

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3.2 Fold-Out Pages

Fold-out pages shall be used only when the technical documentation cannot be presented on standard A4 size (210mmX297mm) pages. All oversize pages shall be prepared for printing on one side. Maximum page size will be A3 size (297mmX420mm) with maximum image area of 267mmX380mm. Where as margins to be maintained inline with the above **Sec 3.1**

Where supplier determines that oversize drawing can be provided within the above maximum page size, drawing will placed in transparent PVC 0.25mm thick envelops appropriately marked and punched for insertion into standard four-post binders.

3.3 Covers/Binders

Pulp board paper covers of 1 mm thick, **punched (for 4 post binders)** shall be used and bound with stapples/temporary binding clips **(Spiral binding / Comb binding is not acceptable under any circumstances)**.

3.4 Language & Units of Measurement

Technical documents shall be written in the English language only unless specified otherwise by Company. Units of measurement shall be specified in Metric Units unless specified otherwise by the Company.

3.5 Document Quality

Documents furnished shall conform to industry accepted quality standards for paper stock, type size and style, legibility and clarity of photographs, illustration, and line drawings and must meet the following requirements:

3.5.1 Workmanship--- Reproductions will meet the following quality standards:

a) Printing is to be clear, sharp, with full uniform ink, coverage, free from filled or broken letters, grayness, smudges or other imperfections and shall be minimum of offset printing quality.

b) Upper, lower and right hand margins will be uniform on all copies, left hand margin is 25 mm minimum.

c) Printed image is square with the trimmed edges of the page.

d) Complete publication will be collated, uniformly and evenly trimmed.

3.5.2 Minimum Type Size---- Type size for text will not be smaller than 12-point.Type size for labels and data on diagrams, charts, graphs, etc. will not be smaller than 10-point.

3.5.3 Photographs and Illustrations --- Copies shall be details and sharp, free of heavy shadows, distorted objects, cluttered foregrounds/backgrounds and give good contrast from white middle tones and black.

3.5.4 Photo-Reductions---For reduced size line drawings, photographs and illustrations, clarity, separation, readability and legibility must be maintained.

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3.5.5 Paper Stock---Paper shall be a minimum of 80GSM executive bond quality. On pages printed both sides, *show-through of images or text is not acceptable and 100GSM EB quality minimum to be used.*

3.6 Identification

3.6.1 Equipment Publications --- Multiple copies of equipment publications for a single component will include one cover page for the lot. Cover page should include all the information as mentioned in **Exhibit-I.**

> **Note:** Where supplier uses a single equipment publication for multiple ratings or sizes of one components type, each copy of the publication will be clearly marked to indicate the specific component rating/size furnished.

3.6.2 Technical Manuals --- Each manual will include a title page which includes all the information (where applicable) as mentioned in **Exhibit II**

3.7 Organization

Composite technical manuals will be furnished by the supplier using the following document organization:

a) **Title page with Suppliers full address, System name & PO details**
b) **Table of contents /Index with page nos**
c) **Tab 1 General Information**
d) **Tab 2 Equipment/System Description and Installation procedure**
e) **Tab 3 Operation**
f) **Tab 4 Maintenance**
g) **Tab 5 Testing**
h) **Tab 6 Troubleshooting**
i) **Tab 7 Reference Drawings, Part lists, Data sheets**
j) **Tab 8 Recommended Spares, storage instructions**
k) **Tab 9 Systems Index.**

> **Note**: Use of label led PVC 0.25 thick tabs to separate main sections of a composite manual is preferred over oilier schemes

4.0 Shipment Date

Complete documentation will be provided 6(six) weeks prior to equipment shipment.

> **Note**: The submission of technical documentation, particularly technical manuals shall not be delayed for reasons of missing or unavailable “as installed” data. As installed in formation in the form of revised drawings, lists, instructions, etc. may be submitted later when the information becomes available.

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5.0 Documentation Updates and Revisions

Subsequent to initial shipment of any technical documentation to Company and throughout the operational life of the equipment, supplier will furnish to the Company all updates and revisions of technical data, instructions, drawings, parts, lists, etc., applicable to the equipment furnished.

Such revisions will include but not be limited to engineering changes, correction of errors or omissions, revised performance ratings, maintenance instructions and safety precautions.

Note: In notifying Company of any revisions, supplier shall clearly associate changes with specific systems or components supplied and will indicate the corresponding Company purchase order number(s)

6.0 Reproduction and Disclosure of Technical Documentation by the Company

All documentation Furnished to the Company by supplier, in compliance with these specifications, shall be of a non-proprietary nature. By supplying such documentation, supplier agrees that the Company may reproduce, disclose and distribute documentation to its customers, users and contractors.

7.0 Drawing Transmittal

The supplier shall prepare drawings/documents and submit these to the Company in accordance with the requirements of Company specification/Standard practice

8.0 Drawing Quality

Drawings shall meet the standards of Company specifications/Standard practices.

9.0 Software preparation

The technical manual prepared should also be converted into PDF format (single file). **This file should be provided on 2 sets of CDs (Floppy disks are not acceptable)** and should be sent along with the 20 sets of manuals. The page format throughout the PDF file should be A4 size except the drawings, which should be in A3 size. Bookmarks should be created and displayed in line with the manual index. Each bookmark should be linked to the appropriate page in the manual soft copy.

The CDs shall contain copies of all the Final Drawings, Technical Datasheets, Sub vendor items catalogues/datasheets, , Guarantee Certificates, approved QP , and relevant type test , routine tests certificates etc.

Exhibit –I Example Cover Page
(For Equipment Publications)

Equipment Publication Title	Publication No.	Issue Date
Component Name	Model No.	Serial No.

Project Name	
Supplier Name	Location
BHEL Purchase Order No	BHEL Ordering Drg. No.

Note: The above cover page example or its equivalent, will be prepared by the supplier. where multiple copies of a publication are provided for a single component, copies will be handed together with one cover page for the lot.
Suppliers shall furnish Company with 20 (Twenty) sets of complete documentation per component, assembly or system furnished unless specified otherwise by the Company.

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Exhibit –II Example Title Page
(For Technical Manual)

Technical Manual Title	Indent No.	Issue Date
Equipment/System Name	Model No.	Serial No.
Project Name		
Supplier Name	Location	
BHEL Purchase Order No	BHEL Ordering Drg. No.	

Note: The above cover page example or its equivalent, will be prepared by the supplier. where multiple copies of a publication are provided for a single component, copies will be handed together with one cover page for the lot.
Suppliers shall furnish Company with 20 (Twenty) sets of complete documentation per component, assembly or system furnished unless specified otherwise by the Company.

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TABLE of Compliance for Spec. GT10564

Vendor shall furnish following clause-wise Table of Compliance during submission of O & M Manual & CDs.
Vendor shall clearly write the confirmation/non-confirmation to every clause in specification.

NOTE : The O & M Manual shall NOT be accepted with out submission of this table.

Abbreviations: Submitted = S.
Not applicable = NA.[provide reasons]

Item as per Clause no. Of spec. GT10564	Submitted / Not Applicable	a) Remarks
1.3		
2.1: Operational checkout:		
2.2 Operating instructions		
2.3 Warnings, Cautions & Notes		
2.4 Maintenance and replacement instructions		
2.5 Troubleshooting Information		
2.6 Testing Instructions		
2.7 Reference Drawings		
2.8 Parts List and Recommended Spares		
3.1		
3.2		
3.3		
3.4		
3.5		
3.7		
9.0(CD submission)		
Unless mentioned specifically, it is presumed that all the other clauses of the specification are confirmed in-toto.		
Filled-up Comliance sheet		

RECORD OF REVISIONS

Rev. no.	Date	Revision Details	Revised	Approved
00	29.01.1998	First made	(V.V.R)	(P.S.C.)
01	06.07.2005	Generally revised, Clauses 09 and Table of Compliance added	(B.V. Lu)	(D.C.R.)

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