SECTION-II

Common Technical Specification

For

Engineering Process Automation of ESP Structural & ESP Components

For

Boiler Auxiliaries Plant
Bharat Heavy Electricals Limited
Ranipet

Prepared	T.Nagarajan	Dy.Manager/EDC -AQCS	
Reviewed	C.Ganesh	Manager / EDC – AQCS	
Approved	S.S.Mani	SDGM / AQCS	25/05/2011

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1.0 Intent of Specification

This specification aims at complete Engineering process automation of ESP structural & component assembly as explained in Section-III & Section-IV through Knowledge Based Engineering (KBE).

The implementation of the above requirement shall be carried out with the following:

- Acquisition and Preservation of Explicit Knowledge Assets
- Creation of Tacit Knowledge Assets
- Knowledge Use and Re-use
- Knowledge Dissemination / Sharing
- Knowledge Security & Access Control

2.0 Introduction About BHEL

Bharat Heavy Electricals Ltd (BHEL) is a premier Govt. of India undertaking and ranks among the top ten power generation equipment manufacturers in the world. BHEL manufactured and supplied approx. 70% of the power generating equipment in India.

3.0 BHEL Knowledge Management Policy

BHEL is committed to leverage its intellectual capital accumulated through R&D and experiential learning of its employees, technology acquisition, etc. and to further acquire, create, protect and share knowledge resources across the organization, in a seamless manner, on need to know basis and manage the same effectively towards value creation for the stakeholders.

4.0 Objectives Of The Proposed Automated Design

- Reduce design cycle time
- Produce consistent design for a given Input devoid of subjective manual decision making
- Evolve and secure Rule-based design institutionalizing design knowledge
- Produce Error-free design documents
- Produce 3D Models for better visualization
- Store design parameters contract-wise for similarity analysis and re-use
- Generate derived documents of the design automatically

5.0 Area of Implementation of KBE

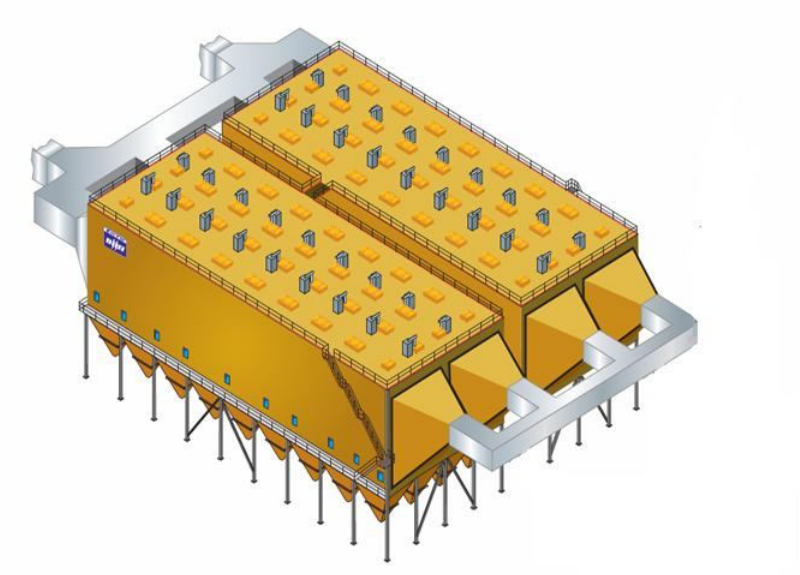
KBE shall be implemented for the following product of BHEL, Ranipet:

5.1Product Description

Electrostatic Precipitators (ESP)

The rapid industrialization of our country has, along with economic benefits, resulted in air pollution from different kinds of industries. Notably, thermal power plants, steel plants, chemical process plants etc. The air pollution from these industries are in various forms like particulate emission, SOx , NOx , etc.

Due to the cumulative effects of these pollutants over many decades, the environmental degradation has become a serious concern for all. The government and regulatory bodies have enacted stringent laws governing air pollution. As a result, a number of industries have or will have to install pollution control equipment (**Electrostatic precipitator**) in their plants to reduce pollution. The Electrostatic precipitator essentially consists of two sets of electrodes called Collecting Electrodes and Emitting Electrodes and (also called Rigid discharge electrodes). The collecting electrode is made up of steel sheet pressed to a special profile and the emitting electrode is of special profile resistance welded with the tubes. A unidirectional high voltage is applied between these electrodes, connecting its negative polarity to the emitting electrodes and the positive polarity to collecting electrodes, which are also earthed. The dust laden flue gas from boiler passes between rows of collecting and discharge electrodes. The high voltage induces ionization of gas molecules adjacent to the negatively charged emitting electrodes.



The positive charges of the ions created travel towards the discharge electrodes and the negative charges towards the collecting electrodes. On their way to the collecting electrodes, the negative charges get deposited on the dust particles. Thus the dust particles are electrically charged. In the presence of high electric field between the electrodes the charged dust particles experience a force which causes the particles to move towards the collecting electrodes and finally get deposited on them. Minor portions of the dust particles, which have acquired positive charges, get deposited on the emitting electrodes also. Periodically these are dislodged from the electrodes by a process called 'rapping'. The particles then fall into the hoppers at the bottom.

5.2 Product Engineering

Product Engineering, is the agency responsible for conversion of customer specification into manufacturing specification.

6.0 Flexibility and user friendliness of module:

The software shall have:

- User friendly GUI for data entry and outputs.
- Flexible for future addition of modules.
- Self explanatory with appropriate comments for every statement.
- Detailed flowcharts for each module

7.0 Implementation Program

7.1 Resource Requirement :

The vendor will be responsible for the successful implementation of the KBE.

The vendor shall clearly bring forth an implementation strategy for the solution.

The vendor shall give the implementation procedure as well as the Schedule for the implementation.

BHEL prefers the shortest turnaround time for implementation. KBE vendor shall consider the required Human resource for the same.

The vendor is to furnish the bio-data of the proposed project team leader and the number of persons to be deployed together with the schedule.

BHEL has no responsibility in any way on the Human resources to be deployed at BHEL for the above activity.

The KBE vendor is responsible solely for the personnel deployed at BHEL.

The project shall be split into phases and each phase can have milestone with a schedule.

All major activities are to be listed and the duration required to be given in terms of calendar weeks.

KBE Vendor should quote for the necessary customization required if any to comply with the tender requirements.

Customer (BHEL) problem reporting and resolution mechanism :

The problems will be reported to the solution provider who will be camping at BHEL during implementation and/or the nearest available office and all solutions / alternatives to be provided to BHEL immediately as required.

Assistance to be provided during this phase for usage of the product developed and assistance for BHEL personnel for further modification or additional features as needed in the software, coding, customization, installation, configuration etc. Vendor should identify a single point contact (resident engineer) for the above and he shall co-ordinate within the KBE vendor's work for the required resources as needed. There will be no service charges payable from BHEL during this phase.

7.2 Project Work Schedule :

Vendor to estimate the work content & time schedule in each of the following phase / module :

(1) System Design and Project Plan.

(2) Development of software program including graphic user interfaces, databases, libraries of 3D Component, Assembly models & drawings, interfaces to other software (for STAAD Pro, SAP2000, ANSYS) required.

(3) Periodic testing of development with participation of BHEL team.

(4) Preparation of system documentation and User Manuals.

(5) Training to BHEL users and system administrator.

(6) Installation of the developed software on BHEL computer system.

(7) Final acceptance testing of installed system by BHEL. **Project Duration–15 months each for Project-1 & Project-2 respectively.**

8.0 Detailed Design Automation (DDA)

The Engineering process automation shall aim at standardisation of product design with minimum number of options and variants. Detailed Design automation shall be done for Electrostatic Precipitators.

The scope involves generation of 3D and 2D drawings of ESP for the BHEL standards.

Electro Static Precipitators

- Single Bus section Type
  - ❖ Single Hopper per Bus Section
  - ❖ Double Hopper per Bus Section
- Double Bus section Type
  - ❖ Single Hopper per Bus Section
  - ❖ Double Hopper per Bus Section
- Steel Casing & Concrete casing
- Inlet Funnel Type
  - ❖ Axial Entry (co-centric & offset)
  - ❖ Top Entry
  - ❖ Bottom Entry
  - ❖ Side Entry
- Outlet Funnel Type
  - ❖ Axial Outlet (co-centric & offset)
  - ❖ Top Outlet
  - ❖ Bottom Outlet
  - ❖ Side Outlet
- Pitch of Collecting Electrode
  - ❖ 250 mm
  - ❖ 300 mm
  - ❖ 400 mm

- Collecting Rapping Mechanism
  - ❖ Single Side
  - ❖ Double Side
- Emitting Electrode Rapping Mechanism
  - ▪ Top Drive
  - ▪ Single
  - ▪ Two Level
  - ❖ Side Drive
    - ▪ Single
    - ▪ Double

ESP Structures and ESP components consist of number of sub assemblies called PGMAs. Typical list of PGMAs for Project-1 and Project-2 is given in Section-III & Section-IV respectively.

The KBE vendor shall generate parametric 3D model for each product variant / sub assembly as required for the ESP configuration as mentioned above (i.e. single/double bus section, different pitch of electrode & different type of rapping mechanism). BHEL will provide necessary Rules / Data / guide lines to prepare the 3D model.

The KBE vendor shall consider the following during the design of Detailed Design Automation (DDA) process.

- o Extraction and documentation of Design rules from the BHEL, Ranipet
- o All the design rules should be entered in database. The system should get the design rules from database rather than using a direct black box.
- o BOM for estimation of total weight.
- o System should produce 3D model first then with the acceptance of the designer of 3D Model then it produces the 2D manufacturing drawings as per the BHEL, Ranipet norms.
- o Generation of 2-D manufacturing drawings covering aspects like component, assembly, developed view, fabrication etc.
- o Generation of input files for GMS, Indenting and fore-casting reports. The present oracle database has to be connected to the present system.
- o Preparation of BOM on the drawings itself and delinking of BOM from Drawing also to an option.
- o Linking BOM to Oracle Data base for generation of GMS, Indenting and material forecasting reports.
- o Any Change in a Particular Component then other components requiring change has to be highlighted and a summary report is to be generated.

- If any part gets updated, then that particular part drawing should get updated with new revision number and a summary has to be generated with list of the change in part & part drawings. The particular change has to be updated in GMS.
- Interconnecting of Gusset Plates for welding or Riveting/Bolting Process.
- Creation of Erection / O&M manual from the Automation Wizard.
- Making user defined library of components for Standard parts.
- Program to be developed to release Spare PGMAs using data available in existing FoxPro/Oracle database.
- Training to users on the developed package.

KBE vendor shall also consider the following during DDA:

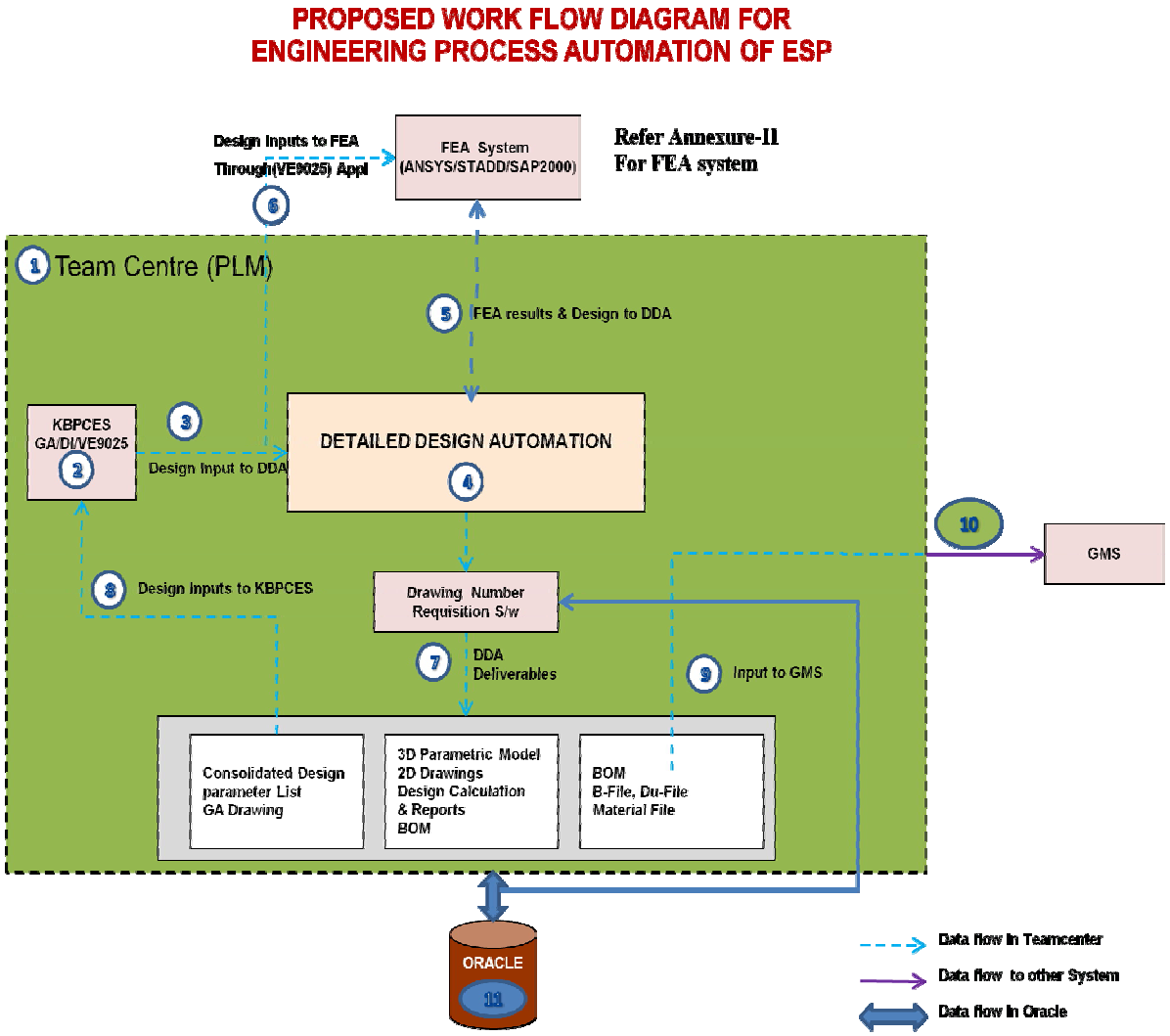
- Develop User friendly GUI
- Use Boiler plant standards (BPS), Rationalised Raw material list (RRM).
- BOM and DU link file generation for GMS program.
- Creation of as built drawings.
- Tolerance Analysis
- Visualisation facility

8.1 Teamcenter Engineering (PLM) Customization

The KBE vendor shall design the customisation suitable for ESP Structural & ESP components during implementation stage. Necessary rules for customisation will be furnished during Design phase.

- Searching for reuse customization.
- Workflows customization.
- Naming rule customization.
- BHEL legacy Oracle to be interfaced with Teamcenter Engineering.
- Comments, Clarifications and Deviations should be captured using Teamcenter Engineering.
- Product Structure Editor (PSE) Customization for NX Models (CAD data)/ Non CAD specific to BHEL requirements. Outputs should be generated for downstream application like GMS (Group Manufacturing Specifications).
- Teamcenter Engineering should be interfaced for material code, R-Indent & Material forecast.

The KBE customization requirement as follows in detail,



KBE Vendor to provide the following features as minimum:

- The software should extend pervasive 2D / 3D visualization within the system portal framework. Integral command sharing through common environment.
- Facility to markup graphical information and enhance interaction with process flows and engineering change management systems.
- Integration between visualisation and the product data
- The software should provide facility to view 3D models in a lightweight Direct Model format with markup, measurement, and sectioning functionalities.
- Real-time access to information in context of the total product.

- Allow capturing images from 3D models from the viewer and save them with markups on separate layers.
- Facility for saving of session files and snapshots.
- The software should provide Mockup functionality and analyse product visualisation from heterogeneous CAD systems, Cross section, interference/clearance checking and other engineering functions.

8.1.1 Knowledge Based Proposal and Contract Engineering System(KBPCES)

KBPCES is a customized process in Teamcenter to manage the proposal management system of ESP in systematic and structured manner.

The KBPCES is customized using Java, Teamcenter, VBA, AutoLisp and Excel.

The Outputs are in Excel, Doc, text, DWG and PDF formats.

In the KBE design automation process, KBPCES deliverables are inputs for the Knowledge Based Engineering (KBE), system should be able to fetch the data from the Teamcenter database / Excel Files or any other file specified for the project /product related Information, hence the Integration portion from KBPCES to KBE to be taken care by the vendor.

Required technologies/system will be given by BHEL for development of KBPCES to KBE Integration.

8.1.2 Design Input to DDA

- Size / Designation of the product fetched from KBPCES
- Product Design input / scope of supply fetched from KBPCES
- GA drawing fetched from KBPCES
- Collaborator's documents
- CCSR
- Shop Problems / Solutions
- Site Problems / Solutions
- Component details (SD, BPS, RRM etc)

User friendly input screens will be provided to accommodate the Design Inputs.

8.1.3 Design inputs to KBPCES (KBE to KBPCES)

On completion of DDA process, the consolidated Design parameter List, GA Drawing and PGMA wise release weight should go to KBPCES.

8.1.4 DDA Deliverables

The KBE vendor shall generate parametric 3D model for each product variant / sub assembly using UG-NX latest version. BHEL will provide necessary Rules / Data / guide lines to prepare the 3D model.

- 3D/2D assembly & part drawings in BHEL format
- Bill Of Materials (BOM) indicated in drawings.
- Material Forecast
- R indents
- Bill of material and the DU link shall be picked up from the individual production drawings
- ODC drawings
- Packing Drawings
- Input file for Design Change Notes (DCN)
- O & M

8.1.5 GMS System Interface Requirements

The Group Manufacturing System (GMS) is a production process mainly used for material collection and to consolidate the material required for producing a Despatchable unit(DU). The BOM of the drawing is transformed in to GMS using design rule.

- The GMS processing will be continue to be in Visual Foxpro.
- The KBE system should validate the Material Code, Unit, Work Order, DU, Description during Modeling. It should access the BHEL Oracle Database for the above validations.
- The DU Descriptions should be standardized as per the logics given by BHEL to facilitate the Outsourcing Department to carry out the Loading of Materials quickly.
- The Bill of Materials (BOM) once finalized should be stored in Team Center, BHEL Oracle Database and also in Text or file format specified by BHEL with Unique Identification for further processing.
- Option shall be provided to process the BOM separately or on the drawing.
- DCN shall be carried out with changes in BOM/ model/ drawing/ GMS as applicable..
- The GMS Project specific Quantity to be taken up in the KBE Module.

- The BOM and DU link file should be given as an Input for GMS Processing System in the File Format specified by BHEL.

8.1.6 Drawing Vaulting System Requirements

For a comprehensive vaulting system the following requirements to be met in Team Center Vaulting.

- All Models to be vaulted in the Team Center with proper logics specified by BHEL.
- At the time of vaulting the drawings into the system , the User should be able to view the drawings (.dwg, .pdf) before submitting it to the Approving Authority.
- The Drawing Numbering Scheme Numbering Scheme generated in Oracle is the reference triggering point for new drawings .
- For DCN based drawings , the system should pick from DCN drawing numbers with app. revisions .
- Drawing Vaulting (New, Revisions) should undergo and approval Work Flow Process. Prepared --> Approved--> ECS Verification --> Archives Verification --> Final Vaulting.
- During Drawing Revision , it should be checked for production status and if it is produced , then the drawing should not be allowed to be Revised. Type of Drawing like Erection , Production, Both to be captured from the KBE System.
- Security feature to be inbuilt into the Team Center to prevent the Users from downloading , Printing including print Screen of Drawings.
- Various types of Query facility is required for drawing viewing like Release ,Material Code, Description , Cust No, PGMA, Drawing No, Title Wise, etc..,
- Existing Legacy Drawings to be migrated , Uploaded into the Team Center after Proper verification , validation for Drawing Number , Revision, Title ,Description.
- During Drawing Vaulting parameters like PGMA,LNOM,BNOM, HNOM, Type of casing, Type of application (for ESP), GA, BPS, std. Drawings ,etc.., applicable for each product to be obtained.
- At the start time of drawing submission (.pdf, .dwg) type of file extension to be validated.
- The drawings should be vaulted in Team Center as well as in the existing folders of ECS servers for Archives to Process after verification.

- Print Request and Printing System for all eligible Users to be enabled. Users should be able to give the print Requisition for one or more selected drawings / documents with the requested number of copies and it has to be sent to Archives for printing .

- Check plot request and printing system . Users should be able to print the drawings before releasing for verification.

- For drawings GMS Released and Production not taken place, DCN is a must for vaulting into the system.

- Drawing Type like standard, Superseded, BPS, GA to be captured.

- The Vendor should follow the Drawing Numbering and Model Naming Schemes as specified by BHEL .

8.1.7 ORACLE Interface Requirements

The required KBE deliverable should be in ORACLE Format.

The vendor shall see the current working systems in Oracle and should link the same functionality in the KBE Modules.

Current working systems

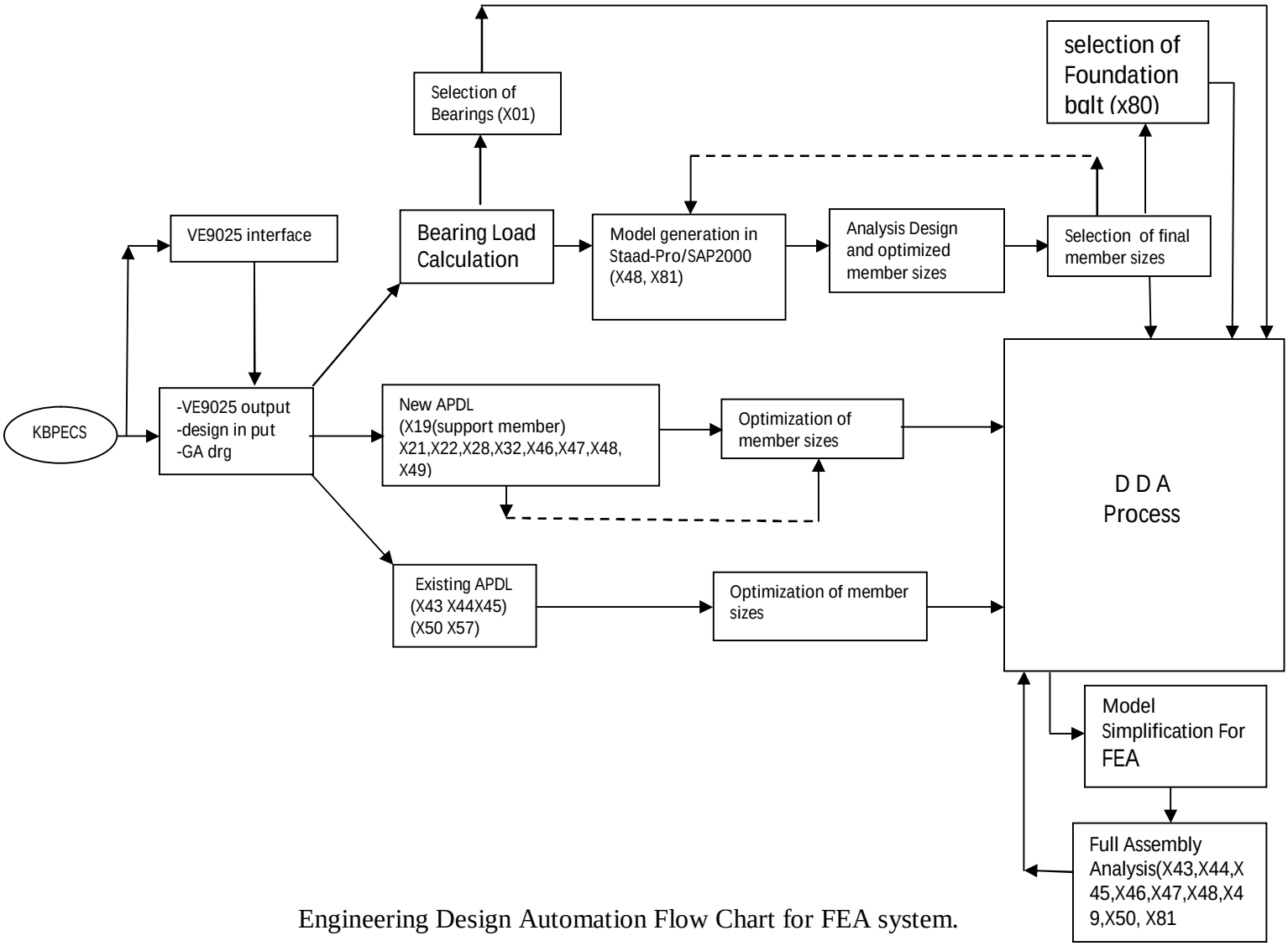
- Material forecast system
- Sub delivery check list system
- R-Indent system

8.1.8 FEM Analysis Requirement

Input from GA drg, VE9025 input, Design Input shall be considered and existing executable file (VE9025) shall be run and ESP member sizing shall be arrived.

- As per above ESP member size parametric model for different PGMAs as defined in Annexure-II shall be developed using ANSYS, STAAD Pro & SAP2000.
- Loading details and Boundary conditions shall be provided in discussion with Design Engineers.
- Available load calculation developed in Excel file shall be integrated .
- Mesh generation, analysis results Plot files, detailed Report shall be also included in parametric model.
- 3-D model of required components are to be integrated for carrying out final FEM analysis, which includes both static and dynamic analysis.
- Existing In-house developed APDL (X43,X44,X45,X50,X57) to be updated and linked.

- Reports and JT data should be vaulted in Teamcenter. (JT is the PLM industry's most widely used 3D data format for product visualization).
- Detail flow chart for FEA system design automation is furnished below,



Engineering Design Automation Flow Chart for FEA system.

Also vendor is to make provision to take the 3D model data to ANSYS for FEA and this is to be incorporated in system and it should be possible to interpret the ANSYS FEA Output for design review interactively.

9.0 Knowledge Use & Re – use

Engineering automation is one of the powerful tools to re-use the design and documentation that has been already made for a given product or project or obtained from the collaborator as basic information. This core and design documentation will reside in custom built product wide engineering automation software.

Both the Knowledge Based Proposals & Contract Engineering Process Automation (KBPCES) and Knowledge Based Engineering (KBE) systems shall be designed to eliminate repetitive activity so as to use or re-use the activity that was already done. This approach aims to achieve the following goals.

- To enhance productivity in Engineering processes
- Prevention of duplicate activity
- To achieve accuracy and consistency on project specific documents
- To reduce cycle time

10.0 Knowledge Dissemination / Sharing

Dissemination is the primary way to leverage the knowledge throughout the organisation.

Data Sharing

- Within the individual Engg group
- Among the Engg. Groups
- Among the Associated functional groups

KBE vendor shall ensure DDA process interface with the PLM software available with BHEL to meet the above requirement and also ERP at a later date.

11.0 Software Requirements

KBE vendor shall recommend suitable software modules in UG-NX if required, for meeting the specification described in various sections also the required no of Licenses & surge requirement license during development phase.

The additional licenses required during development phase should be arranged by the KBE vendor at free of cost.

KBE software should be compatible for future integration with SAP for ERP.

The developed module shall be installed on BHEL's computer and its satisfactory operation demonstrated.

11.1 Suggested software technologies / tools to be used

i) System Designing	UG /NX (latest version), Visual Basic, MS Office Tools, . net & "C" Sharp
ii) 3D models & drawings & 2D Manufacturing & G.A. drawings	UG-NX. User interfaces and design rules are to be developed using NX UI Styler and KF modules respectively. If any other software is required to be developed, prior approval should be obtained from BHEL.
iii) Databases	Oracle
iv) Programming / logics	C, C++, .net
v) Conversion of 2D drawings to AutoCad for Records	-
vi) Development of Integrated system	UG-NX Knowledge Fusion sharing
vii) Front end Display	UI Styler
viii) Operating System	Windows XP Professional / Vista / Windows7/ Windows latest version (32/64 bit version)

The suggested Front End program General Requirements

The Front End / User Input Tools (for capture of Data) should be web based Standard Libraries / Macros to be Used. Coding to be kept a bare minimum. Front End Shall be of VB,.Net ,etc.,

The Front End should be GUI and self explanatory, self validating and user friendly. Error Free Data to be captured. Minimum Input is expected from the Users. System should be able to Trigger the FEM packages and pass the data from / to the package. Team Centre PLM to be used for vaulting the Project / Product Specific Information. Users should be able to query the final Information from the PLM should be able to Interface with the legacy programs like VE 9025 (Fortran) ,VB, .Net, etc. The System should be able to guide the Users in all the End to End Activities of the KBE System. MIRs with Summary / Detailed Reports as specified by BHEL should be able to be generated from the system regarding the status of the projects in totality. All Developmental Licenses **:** Vendor to take care.

11.2 KBE compatibility with softwares available at BHEL

3D Modelling **:** NX 5.0 and above.

2D Drawing **:** AutoCAD 2009 and above

Database **:** Oracle 11g and above

Software / Front End Programs **:** Fortran, Visual Fortran, C, C++, VB, UI Styler, MathCAD, Autolisp, etc

Operating System - Client Side **:** Windows XP, Windows 7 , Windows Vista

FEM Analysis Software - ANSYS, STAAD Pro and SAP2000.

CAD perspective

- Category of Users – Draftsmen, Design Assistants, Engineers, Managers.
- Kind of Network - LAN / Intranet
- Environments - PC / Intranet / Oracle

System Architecture

The system should build as web based architecture, with both fat and thin client support. Web servers like IBM Websphere application server shall be used.

12.0 Resource Requirement

On award of contract, the Knowledge Management solution provider shall have the infrastructure to deploy in the fastest turn-around time, the qualified and skilled human resources at our works to carry out the phased implementation program of Knowledge Management. The solution provider is to furnish the bio data of the proposed project team leader and the number of persons to be deployed together with the schedule. BHEL will discuss further on the possible agreeable schedule before award of contract.

BHEL has no responsibility in any way on the Human resources to be deployed at BHEL for the above activity. KBE vendor is responsible solely for the personnel deployed at BHEL.

12.1 Hardware Perspective

The details of the minimum Hardware environment in which the KBE should function are given below.

• Personal computer with Intel PIV, 3.4 GHZ
• RAM : 1 GB, 4GB

• OS : Window XP SP2 32 bit , Window XP SP2 64 bit , Vista , Windows 7

12.2 UG License details

The following are the current UG License details available with BHEL:

UG Product Code Description No of Licenses

UG Product Code	Description	No of Licenses
NX11111	NX Mach 1 E Design Floating	19
NX13101	NX Mach 3 E Product Design	6
UG10680	NX Knowledge Automation Studio	3
UG30118	Tolerance Stack up validation 6	6
VS20530	TC Visualization Mock Up All Platform Floating	1
VS21405	TC Visualization Analysis Option	1
VS21430	TC Visualization Publish Option	1
IM11865	TC Engg Image Import Utility	1
IM11920	TC Engg Integration for AutoCAD	20
IM11500	TC Engg Product Engineering Server	1
NX30122	NX Weld Assistant	5
NX30474	NX Product Template Consumer	4
NX30472	NX Product Template Author	2

The additional licenses required during development phase should be arranged by the KBE vendor free of cost to meet the surge load.

KBE vendor should arrange any other software required for this development. The developed module shall be installed in BHEL's server and its satisfactory operation demonstrated.

The software module should have provision for editing / modifying the output results after every stage by the user

All units must be in 'mm' by default unless it is specified. The software features employed should be generic so that the developed system should be executable under any higher versions of UG-NX without any modifications in the source code. If it is unavoidable, the developer has to list down those features employed which are version dependent. However, such features must be kept to as minimum number as possible. Upward compatibility must be ensured.

12.3 Technologies and Systems

Following technologies and systems are recommended for BHEL KBE systems:

Technology System

CAD/CAM/CAE	NX5 or later
Operating System	Windows XP or later
Programming	NX/Open (for C/C++, and .net) Visual Studio .net 2003
KBE Programming	Knowledge Fusion
Database	Oracle

MCAD (CAD/CAM/CAE) system is an important component in a KBE system. NX is a next generation digital product development system. With the industry's broadest suite of integrated, fully associative CAD/CAM/CAE applications, NX touches the full range of development processes in product design, manufacturing and simulation. In addition, NX provides a complete suite of integrated process automation tools to enable companies to capture and reuse product and process knowledge.

In most of the KBE projects that have been taken up on NX, these two tools have always been used. In a typical KBE project almost 85% of the geometry creation is through NX ("Template" approach) and about 15% through Knowledge Fusion ("Creation" approach). Another tool which is sometimes used for geometry creation is NX Open API, where the geometry is creation by writing APIs either in C++ or VB .NET.

The best methodology to apply to a project would depend on what KBE is expected to deliver at the end of the project. Sometimes it is necessary to take a hybrid approach where you execute different tasks of the KBE project using different approaches. The three approaches are as follows:

1. Embedding Knowledge into CAD parts through expressions and equations, also called the **"Template" approach**
2. Creation of all parts through Knowledge Fusion. Also called the **"Creation" approach**
3. Creation of all drawing sheets by Open API. Also called the **"Open API" approach** In most projects a combination of these approaches are used and referred to in this document as **"hybrid" approach.** For most of the products of BHEL, that has to be automated, the template approach is used for 85% of the parts and the sub-assemblies and their drawings. About 15% of the parts and their drawings are generated by the other two approaches.

12.4 Programming Quality Practices : Conformance to Requirement

Quality is not perfection or standard, it is the result of a comparison between what was required and what was provided. In its narrow sense, quality of a KF application or a piece of KF code is defined as conformance to requirement.

KF class design specification should consist of following elements:

- Class purpose.
- What to perform?
- Where the class will be used?
- Preconditions.
- Post-conditions.
- Invariants if any.
- Main success scenario.
- Data in – what and where it comes from.
- Data out – what and where it goes to.
- Exceptions if any.

A KF class must be designed, implemented and tested to ensure it meets the design specification.

13.0 Documentation

KBE Vendor to furnish the following documents along with the offer.

- Detailed technical offer along with Hardware / Software configuration diagram, Product Technical literature both in soft form as well as in hard copy.
- Scopes of Deliverables and Services to be furnished.
- Details on customer problem reporting and resolution mechanism approach to be followed during implementation.
- Detail on the systems, tools, and facility required at BHEL during implementation is to be furnished.
- Experience list, commendation certificates, testimonials are to be furnished along with the offer for all the cited software integration.
- Training Modules proposed and courseware considered. The requirement of facility for training to be furnished.
- On award of contract, KBE Vendor shall furnish the following documents:
    - ❖ Application manual, User reference manuals, Maintenance manuals are to be supplied for each module considered for CAD Software.
    - ❖ Hard copies of the above manuals – 2 sets minimum.
    - ❖ Soft copies of the above manuals – 2 sets minimum.
    - ❖ All Software to be supplied in CDs with Original licensing documents

14.0 Training

KBE Vendor shall provide training on the solution offered in a phased manner to all the users, administrator, and the management personnel.

KBE Vendor to formulate a training requirement in the structured manner for direct users and administrator. On-line interactive training module is required for the cited training in addition to the standard training modules.

On completion of the offered training, BHEL personnel should be in a position to use, administrator and modify on incremental requirements without the assistance of the KBE Vendor or any other Product vendor.

15.0 Implementation Program.

The KBE Vendor will be responsible for the successful implementation of the KBE.

KBE Vendor should clearly bring forth an implementation strategy for the solution.

KBE Vendor should give the implementation procedure as well as the Schedule for the implementation. BHEL prefer the shortest turnaround time for implementation. KBE Vendor to consider the required Human resource for the same. The project shall be split into phases and each phase can have milestone with a schedule. All major activities are to be listed and the duration required to be given in terms of calendar weeks.

KBE Vendor should quote for the necessary customization required if any to comply with the tender requirements.

Customer problem reporting and resolution mechanism:

The problems will be reported to the solution provider who will be camping at our office during implementation and/or the nearest available office and all solutions / alternatives to be provided to BHEL immediately as required.

16. Testing & Acceptance Procedure:

The design Automation package developed by the KBE vendor shall be tested based on the suggested test procedure, before development.

(i) The developed system will be tested against the 2D Drawings, BOM already created for different past projects. The number of validations for each model / variant shall be decided by BHEL and vendor on a case to case basis.

(ii) User Acceptance certificate shall be issued only after the successful testing.

17. Intellectual Property Rights :

Vendor shall treat all information that is generated in connection with this assignment as absolutely confidential. All information, analysis, reports and recommendations both in the form of hard copy or on electronic media will be the property of BHEL and must not be used by the vendor for any purpose other than this assignment. All bidders are required to sign non-disclosure agreement with BHEL. On award of the contract, all personnel of the Vendor assigned to and working on the development work has to sign BHEL's '3rd Party Non-Disclosure Agreement'

- Vendor shall indemnify BHEL any copyright or legal liabilities that may arise in use of the developed software or the methodology / models / techniques used by the vendor in development / implementation of the software module.

- In the event that the services are to be provided by Vendor in connection with software programmes and related documentation supplied by BHEL in relation to which rights may be owned by third parties, vendor shall warrant and represent that.

- BHEL has all necessary permissions, express or otherwise, to enable the software programmes and documentation to be copied or otherwise used by Vendor during the course of the services without infringing any third party copyright, patent or trade secret.

- In providing the services Vendor will not be infringing the rights of any third parties.

- The disclosures or use of the software programmes and documentation during the course of services will not involve the breach of any confidential or contractual relationship.

- All source code as well as other deliverables generated under this works will become the property of BHEL.

18 .0 Guarantee

The developed software shall be guaranteed for trouble-free operation for a period of 12 months from its acceptance and installation at BHEL. In case of any defects observed during the operation of this module during this period, the vendor shall render their services at no additional cost for repair / rectification of the same.