BHARAT HEAVY ELECTRICALS LIMITED
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ENQUIRY

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430801601	14-JUN-08	15-JUL-08	

PLEASE SUBMIT YOUR QUOTATION IN SEALED COVER SUPERSCRIBED WITH ENQUIRY NO, ENQUIRY DATE AND DUE DATE SUBJECT TO OUR TERMS AND CONDITIONS ENCLOSED, FOR THE FOLLOWING MATERIALS SO AS TO REACH US ON OR BEFORE THE DUE DATE BY 12 NOON. THE TENDERS WILL BE OPENED AT 2 PM ON THE SAME DAY

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SL NO	DESCRIPTION / SPECIFICATION	UNIT	QTY
1	STRUCTUREL ANALYSIS SUITE AS PER TECHNICAL SPECIFICATION AND GUIDELINES INCLOSED CONNECTION DESIGN AND DETAILED SOFTWARE AS PER TECHNICAL SPECIFICATION ENCLOSED CUSTOMIZATION OF PARAMETRIC PROGRAMME INTO SYSTEM AS PER TECHNICAL SPECIFICATION ENCLOSED.	SET	2

NOTE: PLEASE SUBMIT YOUR OFFER IN TWO PARTS AS PER GENERAL TERMS AND CONDITIONS OF ENQUIRY & CONTRACT FOR THE PURCHASE OF GOODS/SERVICES IN SEPARATE SEALED COVERS AS DETAILED BELOW:

1) FIRST COVER SHALL CONTAIN THE FOLLOWING:

a) TECHNICAL COMMERCIAL BID ALONG WITH COMPLIANCE STATEMENTS, MENTIONING APPLICABLE DUTIES, TAXES etc., AND DELIVERY TIME CLEARLY, (TERMS, CONDITIONS, AND COMPLIANCE FORM ENCLOSED)

b) A COPY OF THE PRICE BID WITHOUT THE P RICES (UNPRICED PRICE BID)

2) SECOND COVER CONTAINING PRICE BID

3) IF THE PRICE BID IS FOUND TO BE DIFFERENT FROM THE UNPRICED PRICE BID IN ANY WAY, YOUR OFFER WILL BE REJECTED

4) UNSIGNED OFFERS ARE LIABLE FOR REJECTION

Important:

Taxes & Duties quoted by you will be taken for cost evolution and order placement and no change will be entertained later except in the case of changes made by the Government. Changes in Taxes and Duties because of the changes in Turnover etc. also be to the supplier's account. Incase no tax/duty is included, a self declaration for the exemption may be attached along with the offer.

AS WE ARE ENGAGED IN R&D ACTIVITY "C" FORM WILL NOT BE ISSUED

Yours faithfully

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ENQUIRY

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for
BHARAT HEAVY ELECTRICALS LTD

RAMESH G
Sr Manager

Email: gramesh@bhelrnd.co.in

Technical Specification for Tender No 43080160

General guidelines for Analysis software and customization

1) Softwares to be installed and tested and training to be imparted at following locations as follows:

a) First copy to be Installed at DNA Group, BHEL R&D , HYDERABAD

b) Second copy to be installed at ASRS Group, ISG, BHEL, Bangalore.

2) For customization of IS801 and input of frames in program - a continuous interaction with BHEL and developer is required for proper guidance from the Indenting department. The supplier should include necessary charges, if any, to facilitate one BHEL Engineer at the developer's office during the course of development of interfacing and logic preparation.
Initially , after placement of order, the Developer has to work with the indenting Department at BHEL R&D Hyderabad to formulate the design procedure and procedure to be followed

3) The IS801 customization as well as the new structural code IS800-2007 has to be implemented . Frame incorporation has to carried on the Structural analysis Suite as given in M01 and also M02
Bothe the software's of structural analysis suite and connection detailing software has to be from the same supplier to have complete interchangeability and design and the customization for this has to be done by the developer or technical representative of that software. In other words, complete package of softwares as mentioned in technical details given under M01,M02 and M03 are to be from the same developer should have 100% compatibility with each other for input data preparation or for interpretation of results and other analytical studies.

4) The logic and guidance given for customization are only indicative to quantify the amount of work involved . The logic of preparing the frames may change during the course of development, if needed. However a detailed logic and procedure will be given at the time of placement of order.

5) The software logic prepared will be the property of BHEL

6) The Developer should maintain strict confidentiality of the joint work being carried out and should sign the confidentiality agreement before starting the work.

7) It is the developers responsibility to test the software and customization prepared for a typical ASRS structural details as given by the indenting department

8) The developer should provide Operating manual and other procedures to be followed for executing the structural analysis jobs using this customized software.

M01 Structural analysis suite ---- 2 copies

Technical specification

a) Structural Analysis + Steel member Designs should include includes: - 3D frame (hot rolled, cold formed) analysis,

- Steel member designs for combined axial & bending forces
  (Interactive member design as well as integrated with analysis)
- Design of plate girder
- Design of Crane Gantry Girder (for up to 2 moving cranes)
- Design & Detailing of Beam- Column (moment) connection
- Design & Detailing of Apex Connection
- Design & Detailing of Hollow Section connection
- Design & Detailing of Double cleat angle connection
  [as per INDIAN,BRITISH, EURO, AMERICAN codes and IS801 Customization]

b) The **Supported steel design codes required are**

- AISC - 1989 ASD.
- AISC - 1993 LRFD.
- AS 4100 - 1998.
- BS5950 - 1990.
- BS5950 - 2000.
- CSA-S16.1 - M94.
- Eurocode 3 - 1992.
- GBL 17 - 1988.
- IS800 - 2007 (IS800-1984 code is not acceptable).
- SABS0162 - 1984 (allowable stress design).
- SABS0162 - 1993 (limit state design).

c) **DESIGN OF COLD FORMED SECTIONS AS PER IS801-1975** reaffirmed2006 is a must and should be incorporated in the program

d) Supported concrete design codes:

- ACI 318-95.
- BS 8110 - 1985.
- BS 8110 - 1997.
- CP 65 - 1999.
- CSA-A23.3-94.
- Eurocode 2 - 1992.
- IS:456 - 2000.
- AS 3600 - 2001.
- HK Concrete - 2004.
- SABS 0100 - 1992.
-

e)Supported units of measurement:

Metric. and imperial

f) The suite of structural analysis and design should have the following features of Frame and finite element analysis.

- **e)Supported units of measurement:**
- Metric. and imperial

f) The suite of structural analysis and design should have the following features of Frame and finite element analysis.

Frame should give the freedom to design in a 2D or 3D environment. The user can decide whether to use the classic input style of nodal input, or any of the one of a number of input wizards. Graphical input should be there in the modeller new graphical editor and modeler.

Plane Frame, Grillage, Space Frame and Space Truss Analysis should be consolidated into a single new module of Frame Analysis. The program should have the capability to allow to start with a two-dimensional analysis and then extend it to the third dimension at a later stage.
Features such as graphical input and design links should be used with plane frame and grillage models as well. Also, advanced features such as dynamic and buckling analyses should be performed with two-dimensional models and 3 D models. Frame should also import both .Dxf and .Dwg files in 2 and 3 dimensions. Frame should have export files for use with Autocad facility

g) Input Wizards

The software should have the capability to integrate t he ASRS frame work as a input as a wizard. This input wizards should make it possible for the average user to input complex ASRS structures
The program should have also the following wizard frames for modelling

Portal Frame wizard,Thrusses and Thrussed Frames wizard, Reinforced Building Frame

Hemispherical Shell wizard and Plate and Solid mesh generator wizard

h) **Graphical Editor and Moddeller** should have user friendly GUI for developing complicated mathematical models like ASRS structures etc

Should be able to enter complex structures with the aid of custom grid. Or generate a tunnel with finite elements i The moddeller should be possible to rotate, duplicate or even arc your structures along a curve.

h)Analysis Types:

The software should be able handle different types of analysis such as

- **Linear analysis:**

  Normal linear elastic frame analysis..

- **Second order analysis:**

  should include Models sway behavior by incorporating P-delta effects. and should have the option for modelling tension only elements.

- **Non-linear analysis:**

  Thi analysis should take care of when large deflections or non-linear behaviour are expected. geometric non-linearity must be supported . The solution should be obtained by a stepped iterative analysis. the program should take care of the following procedure :Loads should be added in steps. The analysis is iterated to convergence for each step so that the reactions and forces are in balance with the applied loads after each step. The deflected structure at the end of each step is then used to apply the next load step and the process is repeated until the total load has been applied.

- **Modal analysis:**

  Calculation of a frame's natural modes of vibration. with a provision to specify the number of mode shapes to be calculated and other dynamic analysis parameters.

- **Harmonic analysis:**

  For determining a frame's response to harmonic loading.

- **Earthquake analysis:**

  Quasi-dynamic analysis of a frame subjected to ground acceleration.

- **Buckling analysis:**

  For calculating safety factors for structural instability due to buckling. with a provision to *specify the number of mode shapes to be calculated.*

i) Beam Analysis For rapid analysis of beams the program should have the following types of analytical capability

i) Input is done in tabular format and analysis results displayed graphically. Any loading configuration should be able to be defined. For the **single span beam analysis**, sections can be read in from the section database. End moments and fixeties can be specified. The output can be post-processed in a design program, eg to check or optimize steel profiles. The Single Span Beam Analysis module should be used to quickly analyse a beam. The beam can be a single span beam or a single span taken from a continuous beam with the appropriate end conditions. The analysis results of steels beams can be post-processed with the steel member design module for combined stress

ii)In the case of the **analysis of a beam on elastic foundation**, variable beam sections, gaps in the elastic medium and rigid supports should be able to be specified. Reaction stresses should be able to be set to allow for uplift or negative soil pressures. The Beam on Elastic Support Analysis module should be able to be used to quickly analyse a beam or slab on an elastic foundation. The beam cross-section may vary along its length and the elastic foundation can include gaps and rigid supports

j) Plane Stress / Strain Analysis

The Plane Stress/Strain Analysis module should be able to be used to perform a finite element analysis of a membrane of any general geometry subjected to plane stress or strain. An automated element grid generation facility should be able to help speeding up the input and analysis processes. Also should be able to take care of when forces are applied to a thin two-dimensional plate in its own plane, the state of stress and deformation in the plate is called plane stress. A typical example would be a shear wall that, due to it being a thin plate, will experience mainly in-plane stresses. No restraint is provided for out-of-plane deformation. On the other hand, a prismatic solid subjected to a constant loading normal to its axis should be able to be analysed as an infinite length of two-dimensional slices of unit thickness experiencing plane strain.

k) Finite Element Modelling

The program should be able to use eight noded quadrilateral and six noded triangular isoparametric finite elements formulated for plane stress and plane strain. A mesh of isoparametric quadrilateral or triangular should be automatically generated and optimised during analysis. Should be able to specify the grid spacing in the X and Y-directions as part of the analysis parameters.

l) Steel Member Design

The member design must be as per **IS800-2007** code (both limit state and working stress design) and also as per **IS801-1975**. The softwares not following these codal requirement will be disqualified.

The steel member design modules should be able to be used for elastic and plastic design of structural steel members. Several modules should act as post-processors for the frame analysis modules, facilitating integrated frame analysis and design. like

i)Member design for Axial or Combined stress
The steel member design modules should be able to suitable for the following design tasks:

- for checking and optimising steel members subjected to axial stress only, e.g. truss members.
- for checking and optimising steel members subjected to a combination of axial and uniaxial or biaxial bending stresses, e.g. beams and columns in frames.

The steel member design modules should primarily act as post-processors for the frame analysis modules. Both modules should have an interactive mode for the quick design or checking of individual members without needing to perform a frame analysis.
ii) Member design for Axial stress

Should have capability to design any hot-rolled and cold rolled section for axial stress.

iii) Member design for Combined stress

Should have capability to design hot/cold -rolled double symmetric sections and channels subjected to axial and bending stress..

iv) Plastic frame analysis and design

The Plastic Frame Design module should perform a linear elasto-plastic analysis of any general two-dimensional framed structure. The program should be used in the following plastic design modes:

- The plastic collapse mechanism and load factors can be determined for a series of load combinations.
- The frame's plastic behaviour can be optimised to achieve more economical sections.

Elastic design of a steel frames should be done using the Plane frame Analysis or Space Frame Analysis modules in conjunction with the steel member design modules axial and combined stress .

v)Determining plastic mechanisms

The program should performs an elasto-plastic analysis of plane frames. A rational analysis approach is followed to obtain a true collapse mechanism for each load case or combination:

- A linear elastic analysis is performed to determine the position of the first plastic hinge.
- The bending moment at that position is then limited to the relevant plastic moment while the position of the next hinge is calculated.
- The procedure is repeated to obtain more plastic hinges.
- If the formation of further plastic hinges results in the bending moment at one of the existing hinges to decrease, that hinge is removed and elastic behavior re-instated at that position.
- The procedure is repeated until a collapse mechanism forms.

Analysis modes
Depending on the analysis module used, the following types of analysis should be able to be performed:

- Linear analysis: Basic linear elastic analysis.
- Plastic analysis: should be able to choose between evaluating the adequacy of the frame as entered or optimising the section sizes. When optimising, the program should be able to search for a more economic configuration of sections. The plastic modulus, Zpl, i should be able to used as the criterion for section economy.

Two design modes should available during plastic analysis:

- No optimisation: Evaluate the frame with sections as entered and calculate the adequacy against collapse for each load combination.
- Optimise sections: Optimise the frame's plastic behaviour by determining more economical sections.

J) Crane gantry girder design

The Crane Gantry Girder Design module modules should be able to be used to design and optimise multi-span crane gantry girders with one or two cranes. Girders may be continuous or simply supported. The program modules should be able to supports multiple combinations of main beams and capping beams, including standard I-

sections, plate girders and box girders.

Crane gantry girders are generally constructed from rolled I-beams or welded plate girder. Channel capping beams are often used to stiffen top flanges. The program modules should be able to check and optimise crane gantry girders made of rolled or welded I-sections or box sections with or without capping beams. One or two simultaneous cranes modules should be able to be specified. The design procedure for crane gantry girders is similar to that used for statically loaded girders. The various loading codes modules should be able to recognise the varying degree of duty of different types of crane and give parameters for horizontal transverse effects. .

k) Plate girder design

The Plate Girder Design module modules should be able to be used to design I-shaped welded plate girders. The program modules should be able to check the behaviour of girders under specified loading and gives guidance regarding bearing and intermediate stiffeners.

The program modules should be able to capable of designing I-shaped sections with identical or different top and bottom flanges. modules. Should be able to also make the section properties vary along the length of the girder to model a tapered element. Tapered sections shoul be possible for design. Bi-axial bending moment
Plate girders are normally used to resist high bending moments and/or vertical shear forces. The program modules should be able to correspondingly assumes that these effects would govern the design and does not explicitly perform the checks for bi-axial bending moment.

The design output modules should be able to show the complete interaction formulae, with the zero values for bending moments about the minor axis. If required, the output formulae can be manually adjusted to include bending about the minor axis.

l) Buckling under axial compression

The program modules should be able to assume that the effect of axial compression is small and therefore uses the full moment capacity for bending about the major axis. No capacity reduction is made on account of buckling about the major axis.

Finally the software should integrate IS801 code and the ASRS frame wizard into its domain for analysis and design of frames with the following modules

Frame analysis 2D

Frame analysis 3D

Finite element Frame analysis

Second order and buckling Frame analysis

Non-linear Frame analysis

Dynamic analysis of frames

Plane stress/plane strain analysis

Single span/cantilever beam analysis

Beam on elastic support analysis

Plane stress/plane strain analysis

Single span/cantilever beam analysis

Beam on elastic support analysis

Steel Member Design

- Member design for axial stress
- Member design for combined stress
- Crane gantry girder design
- Plate girder design

Continuous beam/slab design

Prestressed beam/slab design

Rectangular slab panel design

Rectangular column design

Circular column design

General column design

retaining wall design

base design

Section design for crack widths

section design

Section properties calculator for different cross sections

Wind pressure analysis

Generalised slope analysis

Generalised non-circular slip analysis

Tetrahedral wedge analysis

Planar failure in slopes

Bearing capacity of shallow foundations

Shear strength of rough joints

Detailed Training of the software , which should include the following

- This is an overview of the suite of programs, . Topics include input of data, basic analysis of structures, reading program output

- ***Level 1 :*** This courses should provide an overview of drawing and detailing package. Topics covered should include basic drawing commands, detailing , printing and plotting, and interfacing with other modules.

- ***Level 2 :*** This is a more advanced look at *software* , should concentrate on the new scripting abilities Scripting is a Pascal-based programming language used to write your own sub-programs for all those frequently used actions –

- ***Analysis Level 1* :** This course should provide a general knowledge of using certain *software* modules (namely *Frame*, *Plane Stress Plane Strain*, *Beam* and *Beam on Elastic Supports*) in the analysis of various structures.

- ***Analysis Level 2 :*** This is a more in-depth look at the *Frame* Analysis program. Specialised elements, such as spring elements, shell elements

and brick elements, and their use in modeling are studied. Finite element analysis and the application thereof is should be briefly covered.

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- ***Analysis Level 3 :*** Dynamic (modal, harmonic and seismic) analysis and non-linear analysis procedures and examples are explored. Raft foundations, and other complex examples are also covered, as

- ***Steel and Connection Design :*** This course should concentrate on using the steel and connection modules of steel design.

- ***Concrete Design and Detailing :*** The concrete modules are explored with an eye to more efficient design and detailing of concrete elements within a structure. Both reinforced and prestressed concrete design are covered, as is the finite element analysis of slabs.

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M02 Steel connection design and detailing software ---- 2 copies

Technical specification

Steel connection design should have the following modules

- Design & Detailing of steel Base Plate
-Design & Detailing of fin plate connection< br
- Bolt Group & Weld Group Analysis
- Design & Detailing of End Plate connection
- Design & Detailing of Isolated footing
- Design & Detailing of (two-column) Combined base
[as per INDIAN,BRITISH, EURO, AMERICAN codes and IS801 Customization]

This module should be used and integrated with the structural suite and all the forces and moments should be able to be transferred from the structural analysis software

The software should be able to prepare detailed drawings with bill of materials and export to the drawing software like AutoCAD etc.

The steel connection design modules should be able to be used for design of common welded and bolted steel connection.

- **Base plate design**

The Base Plate Design module should be able to design column base plates subjected to axial force and bi axial moment. Both stiffened or unstiffened base plates should be able to be designed. Base plates can bear on concrete or grout or can be supported on studs. Detailed drawings should be able to be generated for editing and printing using the Drawing and Detailing System. Should be able to take care of :

- The effective applied column force and moment applied to the base plate as a point load in the flanges and a uniform distributed load in the webs of the approximated section.
- The application of the axial force as uniform distributed load in the webs as a mechanism to model the stiffening effect of the webs on the base plate.
- The case of bi-axial bending is by transforming the moments to an effective design moment about one axis. Given the interaction between the base plate and the concrete bearing surface, the clauses of the concrete design codes for bi-axially bent concrete columns are deemed .
- The base plate should be able to analysed as a beam on an elastic support. The resulting concrete bearing stresses or stud forces are applied to the base plate during its analysis.
- Unstiffened base plates are analysed using elastic theory. A rectangular perimeter that encloses the column cross-section is considered and the bending stress in the base plate

evaluated on each of its four sides. The required base plate thickness should be able to be calculated by limiting the bending stress on each of the lines that extend from edge to edge and passing over a side of the rectangle.

- Stiffened base plates are analysed using yield line theory.
- The interaction between the base plate and supporting concrete or grout layer is taken in accordance with the relevant code. using BS 5950 - 1990, the parabolic stress-strain relationship given in BS 8110 - 1997 is used. Similarly, the parabolic relationship given by SABS 0100 - 1992 is used when designing the base plate using SABS 0162 - 1993 and CSA A23.3 - M89 for CSA S16.1 - 1989. In the case of allowable stress design to SAB 0162 - 1984, a linear stress-strain relationship is assumed.

Moment Connection

The moment connection design modules should be able to be suitable for the design of the following connections:

- **Beam-column** connection, BeamCol: Beam connected to the flange of a column.
- **Apex** connection, Apex: Symmetrical beam apex with end plates.

The connections incorporate beams and columns made of I and H-sections.

The moment connection design modules can analyse connections that transmit shear, moment and axial force. Only forces in the plane of the connection are considered, i.e. vertical shear, axial compression or tension and in-plane moment. The connections may be bolted or welded.

The following should be considered**:**

- The centre lines of the connecting beams or beam and column are in the same plane.
- All bolt holes are normal clearance holes.
- Bolts have threads in their shear plane.
- Connections are deep enough for each section's flanges to resist the prevailing compressive and tensile forces.

- Compressive forces in the flanges and stiffeners are transmitted through the welds and not through bearing. Any axial force in the column is ignored.
- Longitudinal and transverse welds in the web plates are full size butt welds.

Hollow section connection design

The Hollow Section Connection Design module should be able to do a complete design of welded structural hollow section connections. The connecting members may transmit axial force and can be circular, square or rectangular hollow sections. I-sections and H-sections can also be used for the main chord.

Various connection layouts can be designed. These include K, T, N, X, and Y joints and combinations thereof.

Shear connection design

The shear connection design modules module should be able to do suitable for the design of the following connections:

- Bolt Group Design : Eccentrically loaded bolt groups.
- Weld Group Design, : Eccentrically loaded weld groups.

When a bolt group or weld group is loaded in its plane and the load does not work through the centroid of the group, additional shear forces are caused in the bolts or welds. The shear connection design modules module should be able to calculate the maximum resistance of bolt and weld groups.

The modules also module should be able to determine the smallest bolt or weld size that can be used to resist an in plane force with arbitrary orientation. In the case of bolt groups, both the cases of single and double shear module should be able to be considered.

The program module should be able to design bolt groups and fillet weld groups subjected to eccentric shear using either **linear** or **non-linear** strength relationships.

Linear analysis

Eccentrically loaded fastener groups should be analysed by considering the group areas as an elastic cross-section subjected to direct shear and torsion. Assuming elastic behaviour, the group's centre of rotation is taken as the group's centroid. The deformation of each fastener is then assumed proportional to its distance from the assumed centre of rotation. The elastic method has been popular because of its simplicity and has been found conservative.

Non-linear analysis

The non-linear method, also called plastic analysis or instantaneous centre of rotation method, should assume that the eccentric load causes a rotation as well as a translation effect on the fastener group. The translation and rotation is reduced to a pure rotation about a point defined as the instantaneous centre of rotation.

Bolt Group Design should be possible

Weld Group Design should be possible

Simple connection design

The simple connection design modules should be suitable for the design of the following connections:

- Double Angle Cleat Connection Design, : Web cleat connections.
- End Plate Connection Design, : Flexible end plate connections.
- Fin Plate Connection Design, : Fin plate connections.

The simple connection design modules should be able to analyse connections that transmit end shear and axial force The following assumptions should be take care, The centre lines of the beam and column are in the same plane. The connection transmits end shear only, Bolts have normal clearance holes.

- All bolts have threads in their shear planes.

Double Angle Cleat Connection Design should be available

End Plate Connection Design should be available

Fin Plate Connection Design should be available

Finally the software should have the following

Intergration with the IS801 code and ASRS frame work

Integration with the Structural Analysis suite specified as E01

Base plate design

Beam column connection design

Apex connection design

Hollow section connection design

Bolt group design

Weld group design

Double angle cleat connection design

Fin plate connection

End plate connection

Drawing and detailing system

Drawing viewer

Document management

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M 03 Customization of parametric frames into software - 1 set

Development of script files to generate required 3D geometry input files.

It is required to model a parametric frame as an input wizard into the software
This wizard will have different dimensions as parameters , which are calculated using a logic as mentioned below. This software so developed have to be integrated into the design and analysis software as mentioned in M01 and M02

Customization of parametric frame

The parametric frame developed is for structural analysis of Racking system frame of a Automated Storage and Retrieval System **(ASRS**) used for carrying bins of different sizes. These systems are deployed basically to store material in large warehouses and retrieve them with the help of cranes for further use.

The *frame* developed is an basic 2D frame comprising of beam and truss elements , which in turn will be generated into a 3D structural frame work inside the program with the help of GUI facilities in the preprocessor of analysis program.

The first step towards developing the 2D frame is to model one column.

The nodal coordinates on these columns follows certain logic and guide lines as listed below

First node at Base of the system

2nd node at a height of L1(Parameter) which is a bin support beam (BSB) location

3rd node may be at next BSB location at a distance of H or it can be a Longitudinal tie location point , which is at height of T1 from bottom

If a tie comes in between two BSB pints, the BSB has to be located 200mm above Tie beam location

The column has to be split at every 2500 to 2800mm , where the cross section may change as per requirement. This joint should be at least 100mm away from any of the points created from above to avoid bolting problems.

The entire column has to be developed to a height of HT with N number of bins and T number of Tie beams.

Z cross bracings (Truss members) location is also near tie locations and between two ties , it will be possible place 2 cross members as bracings in both horizontal X and Z directions

For connecting Mid Beams and Corresponding Z bracing- All the lengths of cross bracings should be same. The total number of mid beam level and number of pairs of Z bracings will be equal to total height divided by

The 3D frame model should also be able to be input from a given table of nodal data or table and or from a 2D dxf file generated.

Create a database of properties and cross section of all types of columns/beams and plates in analysis program/preprocessor as per Indian Standard cold rolled sections and user input cross sections

After generating one column , the same has to be generated/copied as per the given logic , which will be supplied at a later stage.
Thus these generated columns are inter connected with BSB beams, mid beams and Z cross bracings as per the guidelines supplied to forma one single 2 D frame work
This frame need to be generated a number of times and inter connected with Tie members and X cross bracings as provided in the guide lines supplied to successful bidder.

Then the bin loading has to be applied at predetermined locations and bas has to be constrained.
Analysis has to be carried out and design of the complete frame has to be done with the help of Indian codes IS 800-2007 and IS 801-1975. There should be facility to change the properties of each and every element in order to optimize the same. The program should be able to calculate the effective lengths of this 3D frame taking into consideration the support/ end restraints as per code of practice.

This complete customization must be carried out with continuous interaction with one of our structural engineer along with the developer of the program.

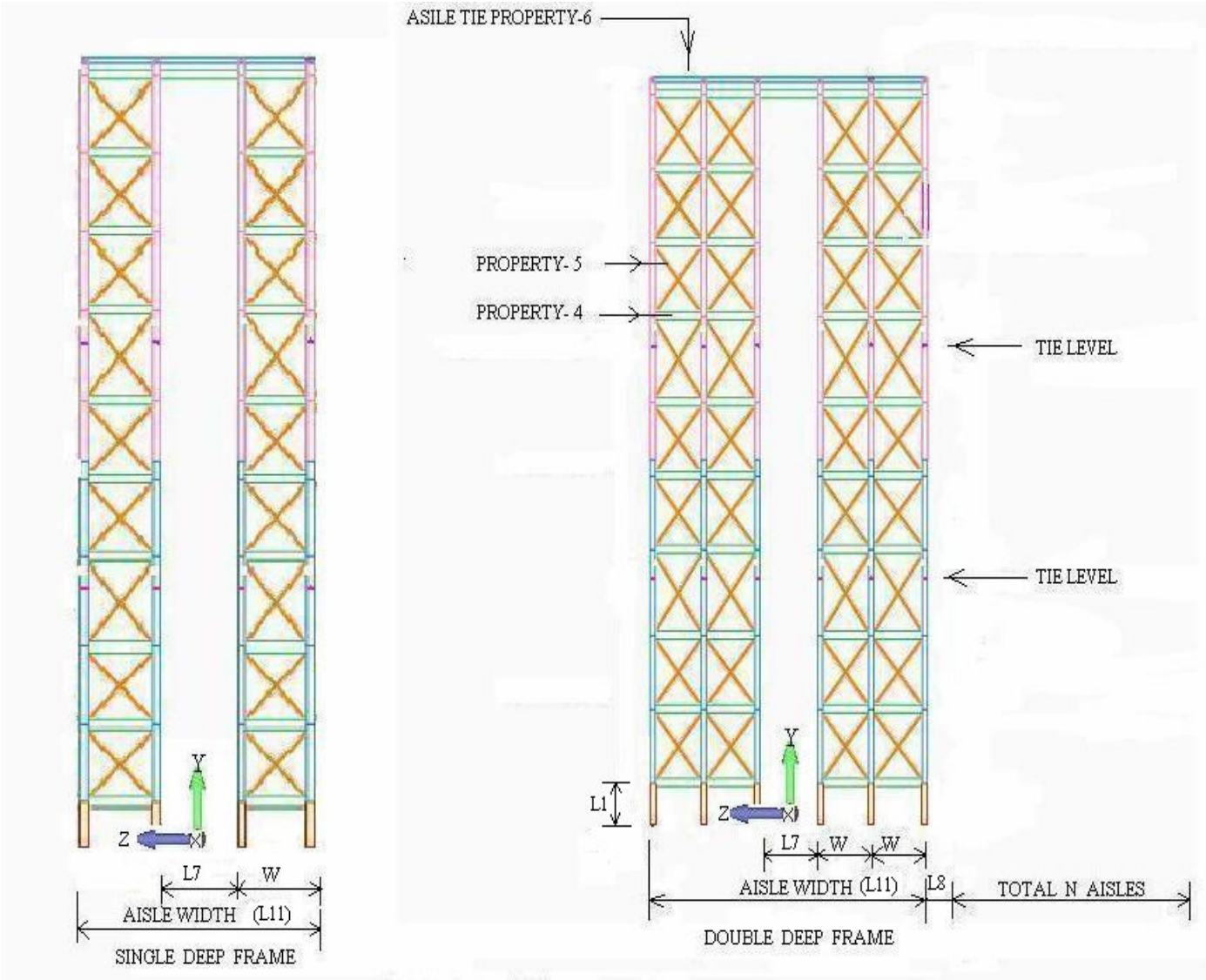

Figure showing a typical frames in 2D

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General Terms and Conditions of Enquiry & Contract for the Purchase of Goods/ Services

1. The quotation and any order resulting from this enquiry shall be governed by these General Terms and Conditions of enquiry and contract for the supply of goods and the supplier quoting against this enquiry shall, unless specifically stipulates any different terms or conditions, be deemed to have read and agreed to the same.

2. Sealed quotations in double cover with tenderer's distinctive seal, superscribing enquiry number, date and due date are to be submitted so as to reach on or before due date & time, addressed to **Additional General Manager(MM), Bharat Heavy Electricals Limited, Corporate Research & Development Division, Vikasnagar, Hyderabad, Andhra Pradesh, India – PIN–500 093, India.**

   In the case of **Two-part bid**, each inner cover shall clearly be labeled as a) **Technical & Commercial Bid** containing technical data/ drawings/ catalogues/ quality plans along with commercial terms and conditions & copy of the price bid with the price columns left blank (unpriced price bid), b) **Price bid** containing prices quotes. Installation and/or Commissioning charges shall be spelt out in absolutely lucid terms, taking into account total charges, rather than quoting vaguely, such as charges per man-day or charges per engineer per day etc. **If the price bid was found later to be different from the unpriced price bid in any way, the offer will be rejected summarily.**

3. **Tender/ Technical bid Opening**: Unless specified otherwise, tenders/ technical bids will be opened on appointed date and time as mentioned in the enquiry or as communicated changed date/time, if any, in the presence of such of those tenderers who may be present.

4. **Delayed/ Late Tender**: Tenders, which have been posted by registered post through the postal department in time before opening date but received after tender opening, shall be treated as regular tenders. Other tenders received after tender opening time shall be treated as late tenders and normally they may be rejected.

5. The Quotation should be free from overwriting and erasures. Corrections and additions, if any, must be attested. Supplier should indicate in the quotation dimensions (Size), weight, rate etc., in the metric system unless the enquiry calls for different unit.

6. **Validity of Quotation**: All quotations shall be kept open for acceptance for a period of ninety days from the date of opening of Tenders/ Technical bid and this shall be deemed to be an express condition of all quotations. The rate shall be quoted in both figures and in words.

7. In the case of Two-part bid, the vendor should furnish technical clarifications, if any, within stipulated time mentioned, failing which, it will be construed that the vendor is not interested in the tender and BHEL shall not consider the offer for further evaluation.

8. **Revision of Pricebid**: In the event of any bidder, after finalizing the technical specifications and scope of supply, opting to revise and submit their latest price bid, then BHEL reserves the right to open their original / previous price bid also while evaluating revised bid.

9. **Pricebid Opening**: Unless specified otherwise in the enquiry, the Price bids of technically qualified vendors shall be opened with prior intimation in the presence of such of those tenderers who may be present.

10. **Conformity to Specifications**: The material should be of the best quality and shall be conforming to our specification given in our enquiry. Unless otherwise agreed upon by BHEL, no payment shall be due by BHEL in respect of any sample. Offers without details of specifications/ applicable catalogues will not be considered and are liable to be rejected.

11. **Terms of Delivery**: All suppliers shall quote the lowest prices on ex-works and FOB/FCA basis. Foreign suppliers will also indicate their Indian agent's name and address with percentage of agency commission out of the quoted price, if any. Name and Address of the supplier's Bankers address should also be given. Indian suppliers for the indigenously manufactured/ imported stock shall quote on Ex-works /Free-on-Rail/Road /FOR-destination basis, indicating packing & forwarding charges, if any, separately.

12. **Taxes and Duties**: Unless specified otherwise in the enquiry, BHEL do not provide "C" or "D" Form as it is engaged in R&D. All Indian suppliers shall clearly mention Sales Tax/ VAT, Excise Duty, and Service Tax etc, if any, payable in addition to the quoted price and indicate applicable rates/ percentage, item-wise. It will be paid

only if Registration Number under State(TIN)/ Central Sales Tax or Service Tax is specifically mentioned in the Bill/Invoice. Vendors without a Sales Tax/VAT registration and applicable Service Tax registration will not be considered.

13. **Insurance:** Insurance will be arranged by BHEL in case of Ex-Works as well as FOB basis supplies.

14. **Terms of Payment:** Full payment will be made within 30 days after receipt, inspection and acceptance of the material (and where involved, Erection and commissioning of the material/ equipment at BHEL/Destination) by Crossed cheque and no Bank commission charges are admissible. The Cheque will be sent by registered post and BHEL is in no way responsible if loss occurs due to delay by postal authorities and cheques falling into improper hands or through forgery or fraud. Suppliers having RBI-SEFT-enabled accounts can seek payment though Electronic Fund transfer. For foreign suppliers, the preferred payment term will be on Sight Draft basis and bank charges inside India will be to BHEL account and outside India will be to supplier's account.

15. Suppliers shall quote competitive price and best delivery for all the items mentioned in the enquiry. BHEL reserves the right to reject partial quotations and to place order on overall landed cost basis. Correct date of effecting supplies in the event of an order should be indicated in the offer. If the supplier's quoted terms are different from BHEL standard payment terms, interest @10.5% per annum (or as indicated in the enquiry) will be loaded to the quoted prices for difference of payment period.

16. **Packing**: The supplier shall be responsible for the goods being properly and adequately packed so as to prevent any loss, damage or deterioration during transit and indicate packing charges, if any, separately.

17. **Part/ Split Ordering**: BHEL reserves right to Order part of the item/ quantity of the enquiry and split the order among qualified vendors.

18. In case the goods enquired are on Rate Contract basis with any other unit of BHEL, such fact should be clearly indicated in the quotation giving full particulars of Rate Contract number, validity and price and also your willingness to comply with order if placed against such Rate Contract. A true copy of Rate contract signed by the supplier should be sent with the quotation.

19. **Inspection**: On receipt, the goods shall be subjected to inspection and also test, if necessary, and our decision regarding the acceptability of the goods shall be final and binding on the suppliers.

20. **Consequences of Failure To Deliver**: The time stipulated for delivery of goods shall be deemed to be the essence of the contract and delivery must be completed within the stipulated date/s. In the event of supplier's failure to supply the goods by the stipulated date/s, BHEL shall be entitled to levy a penalty of ½% per week for the delayed no of weeks or part thereof for the undelivered portion of PO subject to a maximum of 10% total order value.

21. **Withdrawal from the Contract:** In case the supplier withdraws the quotation after its acceptance by BHEL or fails to supply the goods as per the terms and conditions of contract, or at any time repudiated the contract wholly or in part, BHEL shall be at liberty to cancel the Purchase Order and to recover from the supplier the extra cost and other loss incidental to the breach of contract on the part of the supplier.

22. **Guarantee/ Warranty certificate and Manufacturer's Test report**: Invariably in all cases where it is so stipulated, the supplier should furnish Guarantee/ Warranty certificate valid for a period of 18 months from date of supply or 1 year from the date of receipt, acceptance and commissioning(or more, if provide by oem) whichever earlier and manufacturer's Test report along with the goods, failing which, BHEL shall have the right to reject the goods.

23. All ferrous/ non-ferrous items shall be colour coded as per bureau of Indian standards/ or IS standards/ BHEL Standards.

24. **Recovery of Dues**: BHEL shall recover any amount due from the supplier or any amount outstanding to the credit of the supplier with BHEL R&D unit or any other BHEL unit(s) and/or by legal action.

25. **Arbitration & Forum for Legal Proceedings**: All disputes arising in connection with indigenous/ foreign supplies shall be settled through arbitration held at Hyderabad, AP, India and arbitration shall be appointed by Arbitration Tribunal of the Federation of Andhra Pradesh Chambers of Commerce and Industry, Hyderabad, AP, India. The Courts at Secunderabad/ Hyderabad, AP, India shall have jurisdiction in respect of any suit or other legal proceeding arising from or relating to this contract

The rights and remedies of BHEL stated in these General terms and conditions shall be in addition and supplemental to its rights and remedies under law and custom or usage of trade or business and shall in no way be deemed to limit, curtail, supercede or derogate from its said rights and remedies.

ANNEXURE "AA

BHARAT HEAVY ELECTRICALS LIMITED
CORPORATE RESEARCH & DEVELOPMENT DIVISION
VIKASNAGAR, HYDERABAD – 500 093. INDIA

MATERIALS MANAGEMENT DEPARTMENT
(Information for Technical & Commercial bids with general terms)

ENCLOSURE TO ENQ No: **DATE:**

a) **Please indicate(_/) for applicable or (X) for not applicable against each clause of the enquiry**
b) **Vendor shall confirm their compliance for applicable clauses (_/) in their offer without deviation.**

1) <u>Technical offer:-</u>

a) **Vendors to confirm compliance to all points of specifications, attached if any. Deviations if any should be specified in the offer.**
b) **Vendors shall furnish relevant technical Documents / Catalogues. Drawings and Quality plan duly taking care of Purchase Specification and Quality requirements along with their offer in duplicate for Purchaser's review / Verification.**

2) <u>Two Part Bid</u>:-

Vendor shall submit their offer in 2 parts.

2.1 <u>Technical Bid:-</u> Containing relevant technical data, drawings, catalogues, Quality Plan etc, along with Commercial Terms and Conditions and a <u>copy of the price bid with the price columns left blank (unpriced price bid)</u>. <u>If the price bid was found later to be different from the unpriced price bid in any way, the offer will be rejected.</u>

2.2 <u>Price Bid</u>:- Containing the Price(s) quoted. Installation and or commissioning charges shall be spelt out in absolutely lucid terms taking into account the total charges rather than quoting vaguely such as charges as per man day or charges per Engineer per day etc.,

Technical bids will be opened on the due date of the enquiry or any other date fixed by BHEL. Further, vendor should furnish clarifications, if any, required within seven days after the same is sought by Purchaser. If no clarifications/reply received within 7 days, it will be construed that vendor is not interested in the tender and Purchaser will finalise tender accordingly. Price bids received on due date along with technical offers will be recorded and opened subsequently with due intimation to vendors after finalising of technical scope of supply.

These bids shall be submitted in separate sealed covers superscribing the nature of the offer (technical bid or price bid). BHEL Enq No. Due date etc.

Note: In case of non-compliance with the TWO_-PART-BID ie.. clause number 2 and subclauses 2.1 and 2.2. Purchaser reserves the right to summarily reject all such offers.

3) Delivery:-

Vendor shall confirm supply of materials as per the delivery schedule indicated in the enquiry.

4) Negotiations:-

Vendor shall quote competitive price and best delivery to avoid negotiations.

5) Commercial Terms & Conditions:-

Terms of Delivery:

a) Vendors shall clearly indicate terms of delivery Viz: Ex-Works/FOR Despatching station/FOR Despatching station FOR Destination/FOB port of loading/FAS Port of loading in their offer. If the terms of delivery is Ex-Works, then vendors shall clearly indicate the following:

1. **Packing and forwarding charges.**
2. **Documentation / Handling charges if any**
3. **FOB FAS charges (Inland Freight & Insurance charges from vendor works to port of Loading).**

b) All Indian Vendors shall clearly specify the Excise Duty in percentage applicable for their supplies. Offers containing expressions such as "Extra as applicable" or "As applicable at the time of Delivery" will be summarily rejected.

c) CST/Local Sales Tax in percentage shall be clearly indicated.

6) Validity of Quotation:-

Validity of offer should be 90 days after the opening of price bid.

7) Part or split ordering:-

Purchaser reserves the right to order part of item / quantity of the enquiry.

8) For clauses not mentioned in this document see the enclosed "GENERAL TERMS AND CONDITIOINS OF ENQUIRY AND CONTRACT FOR THE PURCHASE OF GOODS"

9) In case your terms of payment are different from our standard payment terms, interest at the rate of 10.5% per annum (or BHEL's standard rate of interest) will be loaded to your prices for the difference of period of payment.

BHARAT HEAVY ELECTRICALS LIMITED
CORPORATE R&D Division
Vikasnagar, Hyderabad – 500093, India.

Suppliers' compliance statement to basic conditions of enquiry

(In case Order to be placed on Indian supplier in Indian currency)

Condition	BHEL R& D's terms	Supplier's compliance (indicate Yes/No. if 'No', state terms desired)
1) Validity of offer	90 days from the tender opening date	
2) Delivery requirements	Free delivery at our stores or FOR destination (as indicated in the enquiry)	
3)Warranty	Unless specifically mentioned in the enquiry, all supplied items to be provided with warrantee for one year (or more, if provided by the OEM) from the date of acceptance/commissioning. In case of equipment involving erection and commissioning, warrantee shall be for 18 months from the date of dispatch or 12 months from the date of commissioning, whichever is earlier	
4) Terms of payment	Full payment will be made within thirty days after receipt, inspection and acceptance of the material at BHEL R&D (and where involved, erection and commissioning of the material/equipment at BHEL/destination), by Crossed Cheque and no Bank commission charges are admissible.	
5) Taxes & Duties	Unless specifically mentioned in the enquiry, we do not provide 'C' or 'D' form. Supplier to specify rates of taxes and duties element wise and related percentages.	
6) Penalty for late delivery	0.5% per week beyond the delivery date as mentioned in the Purchase order on undelivered portion subject to a maximum of 10% of the total order value	

* BHEL R&D reserves the right to reject any offer due to non-compliance with the above conditions and/or non-receipt of this form in duly filled condition
* Any other elements of cost in addition to the above may please be specified in detail

(Signature and Stamp/Seal of Vendor)

BHARAT HEAVY ELECTRICALS LIMITED
CORPORATE R&D Division
Vikasnagar, Hyderbad – 500093.

IMPORTED

Suppliers' compliance statement to basic conditions of enquiry

(In case Order to be placed on the Principal and foreign currency)

Condition	BHEL R& D's terms	Supplier's compliance (indicate Yes/No. if 'No', state terms desired)
01) Validity of offer	90 days from the tender opening date (or as per enquiry)	
02) Delivery requirements	FCA – Nearest International Airport (or as indicated in the enquiry)	
03)Warranty	Unless specifically mentioned in the enquiry, all supplied items to be provided with warrantee for one year (or more, if provided by the OEM) from the date of acceptance/ commissioning. In case of equipment involving erection and commissioning, warrantee shall be for 18 months from the date of dispatch or 12 months from the date of commissioning, whichever is earlier	
04) Terms of payment	Sight draft. All bank charges inside India will be to BHEL R&D account and out side India will be to suppliers account. Documents through State Bank of India, HAL Complex, Balanagar, Hyderabad, AP, India-500 042.	
05) Agency commission	Pl specify percentage charges, if any. Indian agency/agent commission will be in Indian Currency only.	
06) Erection/ Commission	As per enquiry	
07) Documentation	As per enquiry	
08) Insurance	BHEL will arrange Insurance based on intimation to our Insurance agency, United India Insurance Co., DO-2, Secunderabad, AP, India.	
09) Penalty for late delivery	0.5% per week beyond the delivery date as mentioned in the Purchase order on undelivered portion subject to a maximum of 10% of the total order value	

* BHEL R&D reserves the right to reject any offer due to non-compliance with the above conditions and/or non-receipt of this form in duly filled condition
* Any other elements of cost in addition to the above may please be specified in detail

(Signature and Stamp/ Seal of Vendor)

BHARAT HEAVY ELECTRICALS LTD.
Corp. R&D DIVISION
VIKAS NAGAR,
HYDERABAD-500 093 (INDIA)

VENDOR REGISTRATION FORM

[FORM TO BE SUBMITTED* BY THE BIDDER ALONG WITH TECHNICAL-BID]

Before filling please refer to instructions on page-4

1.0 VENDOR PROFILE:

1.1 & 1.2 Name and address of the vender: _____

_____

_____

_____

Phone Nos.:
Fax No.:
Email:

1.4 Local representative of the vender in India/ Hyderabad:

_____

_____

_____

_____

Phone Nos.:
Fax No.:
Email:
Contact person:
Mobile No.:

2.0 & 2.1 Type of Organisation:

PROPRIETORSHIP	COMPANY	SISTER CONCERN	ANY OTHER (Please specify)
PARTNERSHIP	CORPORATION	Small Scale Industry	

3.0 Annual Turn Over:
Name and address of the Banker:

Sr.No.	Bank	Address

4.0 REGISTRATION PARTICULARS

4.1 IT Permanent Account No.(PAN):

4.2 & 4.3 State and central sales tax Registration No.:

4.4 ED/ Service Tax Registration No.:

PF Account No.:

Labour Licence No.:

ESI Account No.:

5.2 Contact person:
Mobile No. :

5.3 Total Number of employees:

Graduates (Engr./Scientists/Mgmt/Fin.)	Consultants	Workers		
		Sup./Skilled	Semiskilled	Unskilled

6.0 Wish to register for supplies/ services other than one bidding for :

Sr.No.	Service/Supplies	Capacity
1		
2		
3		
4		
5		
6		
7		

6.1 Reference list :

(Only recognized public and private sector companies, attach if printed copy available)

Sr.No.	Customer	Volume / Year
1		
2		
3		
4		
5		
6		
7		

7.0 & 8.0 Infrastructure / facilities :

Sr.No.	Facility (with specifications)	Age/ Year procured
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

9.0 Registration with other BHEL Unit/Units:

Sr.No.	9.1.1 Unit	9.1.2 Registration No.
1		
2		
3		
4		

Any Other information :

Declaration:

The information furnished above is true and authentic.

(CEO / Propritor)

SEAL:

Date:

The competent authority reserves the right to accept or reject the registration. Registered vendors will be informed by mail / email, as convenient. Contact Sr.DGM (MM) for clarification/ additional information on registration.
A separate communication will be sent to you in case of non-registration, citing reasons thereof.

Instructions

1. Answer all items, use NA for items not applicable.
2. BHEL units do not require this registration.
3. Submit the form in duplicate.
4. Use additional sheets for want of space if required.
5. Attach copies of latest document s in respect of items 4.0 (Registration no.s)
6. Photographs of registered office and the chief executive/proprietor shall be furnished.
7. Use A4 sheets for this document and the enclosures.

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* REGISTERED BIDDERS, HAVING BHEL (R&D) REGISTRATION NO./ HAVE SUBMITTED THIS FORMAT EARLIER, NEED NOT FURNISH THIS INFORMATION SECOND TIME (UNLESS DESIRE TO UPDATE IT).

BHEL CORPORATE R & D
VIKAS NAGAR- HYDERABAD - 500 093
ANDHRA PRADESH – INDIA
SUPPLIER REGISTRATION FORM

(FOREIGN SUPPLIER)

ALL COLUMNS SHOULD BE PROPERLY FILLED IN THE SPACE PROVIDED FOR. WHEREVER IT IS NOT APPLICABLE PLEASE WRITE "NOT APPLICABLE". INCOMPLETE OR INCORRECT FORMS MAY NOT BE CONSIDERED.

1.0 GENERAL INFORMATION:

1.1….NAME OF COMPANY

1.2….DETAILS OF HEAD OFFICE:

ADDRESS :
TELEPHONE :
FAX :
.EMAIL :
.WEB SITE :

1.3….DETAILS OF FACTORY/WORKS:

ADDRESS :
TELEPHONE :
FAX :
.EMAIL :
.WEB SITE :

1.4….DETAILS OF MARKETING AGENT

ADDRESS :
TELEPHONE :
.FAX :
.EMAIL :
.WEB SITE :

1.5 CHIEF EXECUTIVE

NOTE: PLEASE ATTACH SEPARATE SHEETS, IF SPACE FOUND IS INADEQUATE

AUTHORISED SIGNATORY

BHEL CORPORATE R & D
VIKAS NAGAR – HYDERABAD – 500 093
ANDHRA PRADESH – INDIA

SUPPLIER REGISTRATION FORM

(FOREIGN SUPPLIER)

1.6 CONTACT PERSON(S)
FOR PRODUCT OFFERED
NAME(S)
OFFICIAL CAPACITY
ADDRESS:
TELEPHONE
FAX
E-MAIL

1.7 YEAR OF ESTABLISHMENT

1.8 PRODUCTION CAPACITY PER ANNUM

1.9 PARTICULARS OF PRODUCT INCLUDING SPECIFICATION AND RANGE OFFERED FOR REGISTRATION
(ATTACH BROUCHERS AND CATALOGUE)

1.10 NAME(S) OF BANKERS

1.11 BANKER'S CERTIFICATE

1.12 PORT OF LOADING

1.13 NEAREST AIRPORT

1.14 NAME OF THE INDIAN AGENT, IF ANY
WITH AUTHORISATION LETTER

1.15 ANY OTHER INFORMATION:

AUTHORISED SIGNATORY

BHEL CORPORATE R & D
VIKAS NAGAR – HYDERABAD – 500 093
ANDHRA PRADESH – INDIA

SUPPLIER REGISTRATION FORM

(FOREIGN SUPPLIER)

2.0 FINANCIAL INFORMATION

2.1…TOTAL CAPACITY

2.2…ANNUAL TURN OVER FOR LAST 3 YEARS

2.3…WHEHER CREDIT LICENSE ACCEPTABLE YES/NO

3.0 QUALITY MANAGEMENT SYSTEMS
ENCLOSED FORMAT PART-B

3.1 EXPERIENCE LIST FOR SAME/SIMILAR ITEMS
TO BE ENCLOSED

4.0…..FUTURE EXPANSION PLANS:
(GIVE DETAILS)

5.0 LIST OF ENCLOSURES:
INCLUDING BROUCHERS, CATALOGUES, TECHNICAL LITERATURE etc…

6.0 ANY OTHER INFORMATION

SIGNATURE OF SUPPIER
NAME
DESIGNATION
DATE
…….OFFICIAL SEAL

AUTHORISED SIGNATORY
