

# **SPECIFICATION FOR UPGRADATION OF MULTI-HEAD HOT & COLD INFLEXIBLE COIL PRESS (11/A/2046) INTO A VERSATILE AUTOMATED ONE**

## **Specification No.: MTD-CIM-95-2010-305**

### **1. GENERAL**

We have a hot and cold press which is used for final pressing and curing of insulation of the diamond pulled stator coils of large and medium sized electrical press and large sized straight coils of hydro generators for last 3 decades. These coils are finish pressed (horizontally as well as vertically) to required size by 28 Nos. of swivellable pressing heads and curing is achieved by superheated steam recirculating in Brass Jackets at around 170 °C.

Due to continuous use over last 3 decades the press comes under breakdown very frequently. Moreover, as each pressing head has steel casting block with inbuilt horizontal & vertical cylinder having non-standard sleeves, piston, seals and inbuilt tubings, maintaining the same have become extremely difficult. Further, the components in the power pack & control panel have become antiquated and as such maintaining the same is proving to be very costly & time taking. Further, due to single acting nature of cylinder, the same gets stuck-up during return stroke. This all leads to very low output level of the press (almost 10% of the original).

In order to achieve optimum productivity level and maximise machine availability and do away with the above bottlenecks, it is proposed to redesign & holistically upgrade & automate the total press.

### **2. CONFIGURATION:-**

#### **EXISTING PRESS: (Ref. Dwg. No. 3-MTD-11-2334 & 2343)**

The existing hot and cold press comprises of 28 Nos. of pressing heads mounted on a pair of headers (14 Nos. on each), which in turn is swivellable on trunnion ends mechanised pitch adjustment. The press has motorised adjustment for tilting of header to desired angle for pressing diamond coils, from -25° to +45° from vertical position, tracking motor for adjusting one of the header according to the pitch of the coil, independent hydraulic power pack for each header. The individual heads are mounted at marked position, at a pitch of 254 mm, and there is no lateral adjustment of the same. These individual heads are mounted on a header with integral hydraulic lines for vertical & horizontal cylinder and a common return line. Each head comprises of Casting block (# 1 of Drg. No. 3-MTD-11-2343) Link mechanisms, Fingers, Screw rod-nut arrangement, pins, etc, with horizontal & vertical cylinder bores, cylinder piston with its return spring, sleeve, oil seals, bottom block, isolation arrangement is provided on both the horizontal and vertical cylinder bore. The vertical cylinder pressing force is transferred to the coil thru a linkage mechanism & horizontal cylinder pressing is achieved directly thru the horizontal cylinder.

Steam heated and water cooled brass platens are presently placed on the base, the back pressing face and the cylinder piston end including all necessary steam and water connections for curing of the coils.

#### **PROPOSED UPGRADATION: (Ref. Dwg. No.: 3-MTD-11-2334)**

The proposed upgradation is to be done using existing header as the reference base and redesigning and providing various auxiliaries so as to make the press in league with the

contemporary available automated versions.

Further, only a portion of each head assembly is to be changed which would enable changing of cylinder mounting from internally to externally mounted ones & from single acting to double acting ones, without sacrificing any bit on performance front. Also a new common power pack for catering to both the sides of the press with suitable compensation arrangement would be provided to enable synchronous working of both the arms and sequencing & controlling all the operations by means of a Programmable Logic Controller (PLC) based control panel. Further, controlling of input auxiliaries like steam, water, etc is to be done automatically instead of manually at present. However, the motorised tilting arrangement of the header, the tracking adjustment of the movable header, existing water & steam lines along with the bed is to be retained. The whole Upgradation of the press is to be carried out generally inline with our G.A. Drawing 3-MTD-11-2334, enclosed and would broadly comprise of following sub-assemblies:-

- a) Modified Pressing Head Assembly - Ref. Dwg. No.: 3-MTD-11-2340.
- b) External Header Lines Assembly - Ref. Item # 5 of Dwg. No.: 3-MTD-11-2342.
- c) Hydraulic Powerpack Assembly - Ref. Item # 11 of Dwg. No.: 3-MTD-11-2342.
- d) Hose Drag Assembly - Ref. Item # 12 of Dwg. No.: 3-MTD-11-2342.
- e) Cable Drag Assembly - Ref. Item # 13 of Dwg. No.: 3-MTD-11-2342.
- f) Control Panel (# 9) & Control Pendant (# 10) - Ref. Dwg. No.: 3-MTD-11-2342.
- g) Steam (#14)/Water (#15) Lines Assembly with Brass Jacket Assembly (#8) - Ref. Dwg. No.: 3-MTD-11-2342.
- h) Header Tilting Arrangement - Ref. Item # 6 of Dwg. No.: 3-MTD-11-2342.
- i) Tracking Arrangement - Ref. Item # 7 of Dwg. No.: 3-MTD-11-2342.

#### **A. MODIFIED PRESSING HEAD ASSEMBLY: (Ref. Dwg. No.: 3-MTD-11-2342)**

The existing pressing head assembly comprised of Cast Steel block (# 1 of Drg, No. 3-MTD-11-2343) with inbuilt single acting cylinders & tubings mounted on swivellable Header with inbuilt tubings and corresponding fingers / linkage mechanisms (# 15, 12, 11 of Drg, No. 3-MTD-11-2343). It is proposed to replace the Cast block (# 1 of Drg, No. 3-MTD-11-2343) with a Fabricated block (# 1 of Drg, No. 3-MTD-11-2340) pressing piece, mounting brackets and double acting cylinders. Further a semi-spherical cup(# 17) & New linkage piece is to provide to cater to the new assembly. Rest all linkage element/fingers are to be retained. Also a manifold (# 27) & tubings (# 26) are to be suitably laid out to enable smooth operation of the new head assy. The main block is made out of BQ/Suitable material. All the limiting distances of the existing head are to be maintained in the upgraded head as far as possible. The cylinders used are double acting rectangular horizontal flange mounted with bore of 80mm & stroke of around 40mm.

#### **B. EXTERNAL HEADER LINES ASSEMBLY: (Ref. Dwg. No.: 3-MTD-11-2342)**

The existing header (#3 & 4 of Drg. No. 3-MTD-11-2342) has internal tubings and provides for both as support base as well as feeder line for single acting cylinder. However, with time the same has become leakage prone. As such & to suit to double cylinders, 4 Nos. of external header lines (#5 of Drg. 3-MTD-11-2342) are to be provided on each side. Further connecting tubings along with isolation & flow control valves are to be provided for feeding & controlling input to double acting cylinders (#22 to 26 of Drg. No. 3-MTD-11-2340). The header line should be seamless pipes of minimum 1" nominal bore. The header lines are to be clamped on the headerbox on a tapered angular frame such that the maintainability &

accessibility is ensured. Tappings are taken from each header at 14 positions for connecting the same to the pressing heads mounted manifold thru rigid tubing.

The connections from the header ends to the hydraulic line coming from the hydraulic power pack should be flexible hoses & should be in optimum length such that no jumbling of hoses takes place when the trunnion is tilted from -25 deg. to +45 deg.

### **C. HYDRAULIC POWERPACK ASSEMBLY: (Ref. Dwg. No.: 3-MTD-11-2342)**

The hydraulic power pack for the above Upgradation should be complete with suitable oil capacity tank, breather, oil level indicator, electric motor and control panel & pendants, hydraulic pumps, couplings, guards, high pressure hoses/tubing/connectors, pressure relief valves, non-return valves, solenoid operated direction control valves, return line filter, suction filter, quick release couplings, flow control valves, pressure gauges, shut off valves etc. All the elements incorporated should be pre-tested (Certificates to be shown during inspection). The pressing cycle involves; application of hydraulic pressure upto 210 bar for upto 2 hours in tandem with steam heating & water cooling cycles, to enable consolidation of coils with tolerance of 0.1 mm.

For meeting the above requirement, a high LPM, geared pump operated by around 7.5 HP motor is to be used for initial setting/filling of the headers/cylinders. The pressing beyond the knee pressure to set pressure is done by a low LPM, high pressure radial piston pump. The switching from knee pressure to high pressure, low LPM pump & respective solenoids is to be done by means of pressure switches. Also pressure switches as well as direction control valves of each side of press as well as Horizontal & Vertical pressing are to be independent. Further suitable mutually linked NRV's are to be provided for both the direction control valves for vertical as well as horizontal pressing circuits on either side of press. Suitable manual isolation valves are to be provided so that either of the pressing header can be used. After the first setting in the manual mode, the press is to be switched to auto mode and the high pressure pump would act as a compensating pump. The pressure variation should not be more than  $\pm 5\%$  of the set pressure. The internal leakages should be very low, so that compensating pump should not switch ON/OFF frequently.

The working pressure of hydraulic power pack should be around 210 bar and the pressure switch adjustments should be from 50 to 210 bar. Further suitable glycerin filled Pressure Gauges with needle valve are to be provided for checking the set pressure of the vertical as well as horizontal circuit. Further all hydraulic components to be selected should be rated for around 250 bars. The sequencing of all the operations is to be done by a PLC. The tank capacity should be min. 400 liters and should be provided with suitable water based chiller unit (Further, a Freon based Chiller unit is to be Quoted as Optional). All hydraulic components should be in either Parker/Rexroth/Bosch/Romheld/Towler make only.

Only Rexroth/Parker/Veljan/Wipro/Romheld make cylinders with imported Parker/Shanbom/Busak make Viton seals suitable for steam working temperatures of upto 170° C is to be provided (The same is in BHEL Scope of supply). Further all the hoses to be used shall be rated for a bursting pressure of 4 times of maximum working pressure.

### **D. HOSE DRAG ASSEMBLY: (Ref. Dwg. No.: 3-MTD-11-2342)**

For the hydraulic hoses to be laid for the pressing head line on the adjustable trunnion, the flexible hoses from the hydraulic power pack to the rigid tubing on the adjustable track head, a hydraulic hose with drag chain arrangement is to be incorporated. One end of the drag chain is fixed at the hydraulic power pack input & the other end is clamped to the bracket provided on the adjustable trunnion head. The same is to be around 2.5 m in length.

#### **E. CABLE DRAG ASSEMBLY: (Ref. Dwg. No.: 3-MTD-11-2342)**

For the electrical cable to be laid for the pressing head line on the adjustable trunnion, a cable drag chain arrangement is to be incorporated. One end of the cable drag chain is fixed at the rigid conduits & the other end is clamped to the bracket provided on the adjustable trunnion head. The same is to be around 2 m in length. Both the Hydraulic hose drag chain & the Cable drag chain is to be placed in such a way that both the loop formations are in opposite direction. Also a Cable drag chain is to be provided for Control pendant cables.

#### **F. CONTROL PANEL & CONTROL PENDENT: (Ref. Dwg. No.: 3-MTD-11-2342)**

The control panel is to be Programmable Logic controller (PLC) based with all the push button controls like Main motor ON/OFF, Compensating motor ON/OFF, Existing Tracking and Tilting motors (For each header box unit) ON/OFF to be integrated into the panel, Auto/Manual mode, Overload etc and Pressure switch contacts as Digital Inputs & Solenoid valves of each of the direction control valves; Signal to Main motor contactor & Compensatory motor contactor etc. as outputs. The PLC should be S7 series of Siemens/Equit. Of Allen bradley. All the valves/ motors etc. are to be actuated through interposing relays with suitable snubber circuits, PLC should leave at least 30 DI & 16 DO and atleast, 15% of the same should be spare.

All the controls are to be provided on control panel. The control panel is to be ergonomically built & should be in conformance with IP54. It should be atleast 300 mm above the floor level so that maintenance people can access it without being required to lie down. The wiring is to be ferruled & properly laid out. The same should be of self standing type and should be spacious enough to accommodate all the power and control elements like contactors. Fuses, Motor overload, Drives etc. Suitable conducting & cabling are to be provided for the same.

In addition to the control panel 2 Nos of control pendants are to be provided to be mounted on the press itself with control of individual header lines on each of them. The control pendent should have control for track adjustment, header lines tilting, horizontal and vertical manual adjustment, Auto cycle selection, Emergency stop etc.

A Two set point temperature controller unit is to be provided to display & control the temperature upto 200° C. This unit is to be flush mounted on the door of the Control panel and should be of 1", 3 digit specification & should be provided with a iron constantan thermocouple which is to be placed near the job.

An additional temperature display along with TC is to be provided to display incoming steam temperature. The cable from the thermocouple is to be properly routed through the conduit. A TD200/Suitable HMI is to be incorporated for providing Data interference to operation & fault enunciation.

#### **G. STEAM/WATER LINES ASSEMBLY WITH BRASS JACKET ASSEMBLY: (Ref. Dwg. No.: 3-MTD-11-2342)**

The brass jackets are heated by steam which is available at 12 Kg/cm<sup>2</sup> and 170 °C and cooling of the platens is done by cold recirculating water at around 25°C. Manually operated valve / stop cock are provided at the inlet & outlet of both steam & water connection. Further piping of steam & water is to be same, except at inlet pneumatic actuated solenoid valve is to

be provided for steam & solenoid valve for water line. Steam, water piping & associated valves/drain traps would be used as existing. However 12 pairs of steam hoses with connectors are to be supplied.

Further, hot steam pipes are to be lagged with thermal insulation such as ceramic modules and covered with aluminium/GI sheets and clamped properly by the supplier (This is the Scope of the project).

#### **H. HEADER TILTING ARRANGEMENT: (Ref. Dwg. No.: 3-MTD-11-2342)**

The present Header tilting arrangement which comprise of a 0.125 HP, 960 RPM based drive arrangement for the fixed & adjustable headers are to be retained. The same is to be electrically integrated into the Upgradation package & the controls for the same is to be provided into the individual control pendants.

#### **I. TRACKING ARRANGEMENT: (Ref. Dwg. No.: 3-MTD-11-2342)**

The present adjustable track arrangement comprises of a 0.5 HP, 960 RPM based drive arrangement and the same is to be retained. The same is to be electrically integrated into the Upgradation package & the control for the same is to be provided into the control pendant mounted on the adjustable header.

### **3. PROPOSED METHODOLOGY OF OPERATION AFTER UPGRADATION:**

After the implementation of the proposed up-gradation, the methodology for operation of the system would be as follows:

- a) Adjust the pressing heads viz-a-vis adjust the track according to the coil pitch and tilt the headers so as to achieve the required included angle of the diamond coils. (No angular adjustment required for hydrogenerator straight coils)
- b) Place the steam jacket at the bottom and back side of the fingers.
- c) Place the diamond/hydrogenerator straight coils into the opening and place another steam jacket in front of the horizontal pressing cylinder.
- d) Now insert suitable pressing tools.
- e) Place the suitable pressing strips on the coils and close the top rocker arm thru adjustment of vertical screw against the semi-spherical bush. Tight suitably to avoid any angular movement of linkages.
- f) Start both the Main & Compensation pump in manual mode and adjust the horizontal & vertical cylinders, independently.
- g) Adjust the pressure setting of the pressure switches.
- h) Open the steam shut off valve to allow steam to flow thru the jackets.
- i) Start cycle in Auto mode whereby the pressing control would be done by Pressure switches.
- j) Once the curing is done for the specified period close the steam shut of valve & open the water line into the same circuit.
- k) Once cooling is done upto desired period, cycle is shut of automatically.

### **4. JOB / EXISTING PRESS SPECIFICATIONS:**

- a) Max. section of the coil to be pressed - 125 mm x 50 mm (Present capacity to be retained) .



- b) Pressing head horizontal daylight ~ 154 mm
- c) Pressing head vertical daylight ~ 210 mm
- d) Present stroke of Horizontal & Vertical cylinder – 25.4 mm (1")
- e) Material of the coil - Electrical grade of copper.
- f) Max coil pitch ~1500mm (Approx)
- g) Minor coil pitch ~200mm (Approx)
- h) No of pressing unit/Row - 14 on each header.
- i) Total No. of pressing units - 28
- j) No. of pressing cylinder (2 per unit) on each header box - 28
- k) Total No. of pressing cylinder - 56
- l) Pitch of the pressing units ~ 254mm (Fixed)
- m) Max. load on each RAM ~ 8 Ton
- n) Max. pressure on the coil surface ~20 Kg/ cm<sup>2</sup>.
- o) Max. trunnion (Header Box) center ~ 1970 mm
- p) Min. trunnion (Header Box) center ~ 550 mm
- q) Max. clockwise angular position of trunnion from vertical plane ~ 45°
- r) Max. anti-clockwise angular position of trunnion from vertical plane ~ 25 °
- s) Steam jacket size - 152mm x 50mm (6" X 2")
- t) Hyd. pump motor – 4 HP, 1440 RPM
- u) Tilt motor rating - 0.125 HP, 960 RPM
- v) Tracking motor rating - 0.5 HP, 960 RPM
- w) Track locking arrangement - Thru Locking hand wheel
- x) Overall length of press ~5560 mm
- y) Overall width of press ~ 3650 mm
- z) Overall height of the press form floor level ~1600 mm

**5. BROAD SPECIFICATION OF THE PROPOSED UPGRADATION SYSTEM: (Ref. Dwg. No.: 3-MTD-11-2334/2340)**

**MODIFIED PRESSING HEAD:**

- a) Mounting block width ~ 150mm.
- b) Mounting block overall width ~ 240mm.
- c) Material of block ~ BQ quality plate/Suitable.
- d) Cylinder mounting brackets - MS fabrication for horizontal and vertical mounting.
- e) Vertical links ~ C-45 machined plates.
- f) Semi circular bush ~ machined bush (BQ).
- g) Insulation arrangement ~ Sindonia sheet/suitable material.
- h) Cylindrical bush - Sandwiched bush with insulation plate.

**HYDRAULIC UPGRADATION PACKAGE: - (Not in Scope of this Project)**

- a) Hyd. cylinder nos. - 60 Nos.
- b) Hyd. cylinder type - Double acting type
- c) Hyd cylinder mounting type - Rectangular horizontal flange mounted
- d) Hyd. cylinder bore – 80 mm.
- e) Hyd. cylinder stroke ~ 40 mm
- f) Hyd. cylinder rod dia. ~ 45 mm.
- g) Hyd. cylinder max. length ~ 300 mm.
- h) Max. working temperature of the steam ~ 170° C

- i) Hyd. cylinder seals –Viton Seals of Parker/Shanbom/Busak make suitable for above temperature only.
- j) Cylindrical cushioning - Not required
- k) Hyd. power pack Main motor rating ~ 7.5 HP, 25 LPM.
- l) Hyd. power pack Compensation motor ~ 2 HP, 2 LPM.
- m) Hyd. oil tank size - 400 Lts (1000mm x 800mm x 500mm )
- n) All headers to be of 1" nominal bore size of suitable length.
- o) 2 Setpoint temperature controller with pneumatic actuated solenoid valve ~ Range 50° C to 200° C.

#### **MAKE OF B.O. ITEMS:-**

- a) Make of motors - Bharat Bijlee/ABB/Siemens only.
- b) Make of pump - Dowty/Rexroth/Towler/Bosch only.
- c) Make of Hyd. cylinder - Rexroth/Veljan/Wipro/Romheld/Parker only.
- d) Make of Hyd. elements – Rexroth/ Bosch/Parker/Romheld/Towler only.
- e) Make of PLC – S7 series of Siemens/Equivalent of Allen Bradley only
- f) Make of Control elements - Siemens only.
- g) Make of cable drag chain - IGUS Only
- h) Temperature Controller Make - Chino/Eurotherm/Yukokawa/Radix only.

#### **6. SCOPE OF SUPPLY:-**

- a) Pressing Heads as per above details (Hyd. Cylinders in BHEL Scope) : 28 Nos.
- b) Hydraulic Power pack with Valves, PG, Pressure Switches, Pumps, : 1 Lot  
Motors, 400 Lts tank, Hydraulic Hose Drag Chains, Headers, Rigid  
Copper/suitable tubings, Flexible hoses, Quick connecting couplings,  
Water based chiller unit etc.
- c) Mechanical Kit comprising of bracketories, fasteners, fittings, : 1 Lot  
manifolds, etc.
- d) Screw rods with nuts (# 8 of Drg, No. 3-MTD-11-2340) : 5 Sets
- e) Semi-spherical bushes (# 17 of Drg, No. 3-MTD-11-2340) : 28 Nos
- f) PLC based Control Panel : 1 No.
- g) Control pendants to be mounted on Press. : 2 Nos.
- h) Pipes, Hoses, Manifolds, Connectors, Valves, Brackets, : 1 Lot  
Lagging material, Solenoid valves, NRVs, Steam trap etc. for water  
& steam connection as per circuit
- i) Foundation bolts, levelling screws, plates, bolts, nuts, screws, : As reqd.  
dowel pins, limit switches etc.
- j) Operations & maintenance manuals : 4 Sets
- k) Test & Guarantee Certificates : 4 Sets.
- l) Freon based intercooler for Hyd. Oil Cooling in lieu of Water chiller  
(To be quoted as Optional) : 1 No.
- m) Steam hoses (To be quoted as Optional) : 12 sets.(24 Nos.)
- n) Spare parts (To be quoted as Optional as per para#9) : 1 Lot

#### **7. SCOPE OF WORK WOULD BROADLY BE AS FOLLOW:**

- a) Existing casting pressing heads are to be changed with machined block based pressing heads on to the existing headerbox (trunnion).

- b) Mounting of brackets for cylinder mounting & linkages to be incorporated.
- c) Provision for suitable Hydraulic power pack to be provided.
- d) Hydraulic piping with necessary external headers, flexible tubing, valves, connectors, hydraulic hose drag chain etc is to be provided for all the pressing heads, viz on fixed track and adjustable track.
- e) Control panel and control pendants with cable routing thru drag chain, steel reinforced PVC conduits etc to be carried out.
- f) Existing steam/water circuit is to be used for curing. But lagging of the existing steam line is to be carried out & pneumatic actuated solenoid valve & solenoid valve for steam & water circuits to be provided.
- g) Integration of the existing drives for track adjustment and pressing heads tilting arrangement into the New control panel/pendants.
- h) Complete painting of the press with heat resistance paint of Verdigris Green colour.
- i) Complete installation & commissioning of the press and proving out of the same for derived performance upto the satisfaction of the user.

**Note:** - Supplier to bring their own technicians and tools for doing the above work. All Civil work shall be done by BHEL. Help of crane & hand drilling press shall be given.

## **8. ELECTRICAL EQUIPMENT:-**

All electrical control components are to be of Siemens make only. We are having only 415 volt AC, three phases, 3 wire supply. No neutral is available. Control circuit is to at 110 V AC. Suitable transformer is to be incorporated for the same. All the wiring in the panel is to be well laid out through PVC channels and outside the channels the same are to be routed through steel reinforced PVC conduits of Finolex/ Equivalent make. All the wire terminations are to be properly ferruled and provided with lugs. All control components are to be mounted on DIN channels. Further the panel should be generally in line with IP54 and appropriate ISs are to be followed for deciding colour coding scheme of the wires. Suitable glands are to be provided for all the cable terminations/ junctions.

## **9. SPARES:-**

Spares for successful running of system for 2 years should be incorporated in scope of supply. This may be quoted separately. A list of spares required thereafter with information on their normal life should be given. Offer of essential spares is required separately.

## **10. TEST AND GUARANTEE:-**

The system should be guaranteed for a period of 12 months after commissioning for any breakage, faulty material or workmanship and supplier should replace the parts during this period free of charge.

Further, test certificates in respect of this equipment and other bought out items going into this is to be furnished at the time of inspection.

## **11. INSPECTION AND SYSTEM CHECKS:-**

Inspection of the elements will be done at supplier's works before dispatch to see the workmanship, lubrication arrangement, straightness, concentricity, flatness and alignment of the major items and physical inspection of B.O. items and testing of power pack etc.



## **12. DESIGN APPROVAL:-**

The manufacturer should present Design/Drawings (2 Sets) for our concurrence before starting its manufacturing. For any deviations/changes from our specification, 'they will have to take prior approval.

Despite the design concurrence, final responsibility of proving the system at BHEL shall be that of the manufacturer.

## **13. LITERATURE:-**

Four sets of following is to be furnished.

- a. General layout drawing showing construction details, dimensional details and location of various items.
- b. Operating, servicing and installation manuals of the equipment system. It should also contain full electrical schematics, wiring diagrams and circuit diagrams of conversion package.

## **14. ERECTION AND COMMISSIONING:-**

The installation, commissioning and proving of the entire system is to be done on 4 nos. of actual jobs at our works to the satisfaction of BHEL engineers. Any specific help required from BHEL may be clearly indicated in the offer. Suppliers have to bring their own technicians/fitters/engineers.

## **15. SAFETY:-**

The system should be provided with suitable safety devices to guard the system from any damage and also for the safety of the operator.

## **16. DETAILS TO BE FURNISHED WITH THE OFFER:-**

Following details must be supplied with the offer:-

- a) Only Parties who have supplied Multi-Head Presses working at 210 bar or executed such Upgradation and is working satisfactorily for last 1 year need to quote. List of customers along with contact details to be furnished.
- b) Full technical details/specifications, general arrangement drawing, electrical schematics, control diagrams illustrating construction of the system along with the Hydraulic Circuit Diagrams. Submission of same is must for further processing of offer.
- c) Material specifications which are used in the manufacturing of the equipment.
- d) Point to point reply to specification is must for further processing of the offer.
- e) Overall dimensions and space requirements.
- f) Power requirements.

## **17. OTHER UTILITIES AVAILABLE WITH BHEL:-**

Compressed air at 3 kg /sq. cm Max. and regular water supply are available but constant water supply for cooling purposes cannot be given.

## **18. AMBIENT CONDITION AND TROPICALISATION:-**

All electronic components should be tropicalised to with stand environmental temp. variation from 4 to 50 degree and RH variation from 5 to 95 %.

#### **19. STRESS RELIEVING OF ALL FABRICATED ITEMS:-**

All fabricated brackets / items are to be stress relieved and certificates for the same to be furnished.

#### **20. MATERIAL & HEAT TREATMENT FOR MAJOR COMPONENTS :-**

All wear components (in motion) needs to be properly heat treated for maximum durability. Further test certificates for the critical materials like cylinder body etc are to be furnished.

#### **21. PAINTING:-**

The equipment, including existing press, should be painted in Heat Resistant Verdigris green colour after up-gradation work.

#### **22. TRAINING:-**

Training should be imparted to our operators & maintenance team for 3-4 days so that they should be in a position to run / maintain the system independently.

