EDC- Gates & Dampers	**Bharat Heavy Electricals Ltd** **Boiler Auxiliaries Plant** **Ranipet-632 406**	**TECHNICAL DOSSIER for 57-570** **FGD OUTLET GATE**

NTPC VINDHYACHAL -1x 500MW (R549)

SlNo	Particulars	Document reference
1	General specification of FGD Outlet guillotine gate	GDRS: 017
2	P&ID of FGD Outlet Gate & Seal Air Piping	4610-101-04RP
3a b	BHEL Quality Plan Sample MQP format for Bidder's reference	R501/04 1 page enclosure
4a b	NTPC format for Evaluation Report - For Bidders information - To be filled and submitted by Bidder	QS-01-QAI-P-04 / F1-R2 (1 page) QS-01-QAI-P-04 / F2-R1 (7 pages)
5	Painting schedule	PS VINDHYACHAL R549 Rev00 dt:16.08.2012
6	Technical Specification for LT Motor of Seal Air Blower	TECI: LT MOTOR: Rev01
7	NTPC Technical specification for Instrumentation	Inst_Spec - 57570
8	Leak Tightness Type test procedure	G&D : LTTP
9	Data sheet- FGD Outlet Guillotine Gate	DS – 57570
10	Specification & Datasheet for Electrical damper Actuators	TDA : NTPC :DAE:OCIS / Rev.03
11	Proforma Invoice - FGD Outlet gate (Price Schedule)	PI – 57570
12	Document Submission Check list	CL-GT-57570

Filled up sl. nos. 4b and sl.nos. 9 to 12 to be submitted along with Technical Offer.

Rev. 00.dt.15/10/2014 : Original Issue

Prepared	Checked	Approved
M. Suresh Engineer –EDC /G&D	V. Kesavan Sr. Manager – EDC /G&D	D. Ashwin Dhinakar Sr. Manager – EDC /G&D

VINDHYACHAL– 1x 500MW (R549)
FGD OUTLET GUILLOTINE GATE

SPECIFICATION No.: GDRS: 017 /Rev.00

TECHNICAL SPECIFICATION

for

FLUE GAS DESULFURIZATION OUTLET GUILLOTINE GATE

CUSTOMER : NTPC LIMITED

Prepared	Checked	Approved
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Rev.01	

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26	MQP Sample format for reference only	1 page
27	NTPC format – Evaluation Report (for information only)	QS-01-QAI-P-04/ F1-R2 (page 1 of 1)
28	NTPC format – Evaluation Report (to be filled up and submitted by bidder)	QS-01-QAI-P-04/ F2-R1 (page 1 to 7 of 7)
29	Painting Schedule	PS VINDHYACHAL R549 REV.00 dt 16.08.2012 (1 page)
30	Technical Specification for LT Motor (Applicable for Motor of seal air blower)	TECI: :LT MOTOR: REV 01
31	NTPC Technical Specification for Instrumentation	Inst_Spec-57570
32	Leak Tightness Type Test Procedure	G&D: LTTP
33	Data sheet for FGD Outlet Gate	DS-57570
34	Specification for Electrical damper Actuators	TDA:NTPC:DAE:OCIS /Rev.03
35	Total Final Price Schedule (Proforma Invoice)	PI- 57570
36	Check List for FGD Outlet Guillotine Gate	CL-GT-57570

Filled up sl. nos. 28 and 33 to 36 shall be submitted by bidder along with Technical Offer.

1.0.0	**PROJECT INFORMATION**	
	▪ Owner	NTPC Ltd.
	▪ Buyer	BHEL, Ranipet
	▪ Process/ application	Wet Lime Stone FGD system
1.1.0	**SITE CONDITIONS**	
	▪ Ambient temperature (Guarantee)	27 Deg C
	▪ Ambient temperature(Max.) ▪ Ambient temperature (Min.)	50 Deg C 6 Deg C
	▪ Relative Humidity	60%
1.2.0	**LOCATION and APPROACH**	
	▪ Project location	Vindhyachal STPS, Vindhyanagar
	▪ District	Singrauli
	▪ State	Madhya Pradesh
	▪ Height above sea level	281m
1.3.0	Other Project details	
	▪ Seismic load	As per IS: 1893 (Part I); 2002 and IS: 1893 (Part 4): 2005
1.4.0	Wind Load a) Basic wind speed at 10 meters above the mean ground level b) Risk coefficient, " K" c) Category of terrain	As per IS: 875 (Part-3) 47 m/s 1.07 Category – 2

2.0 Application:

Gates (Guillotine damper) are required for isolation of Flue Gas Desulphurization(FGD) plant, Gates are provided at the FGD inlet and other at the FGD-outlet. These Gates are normally open when the FGD plant is in working condition. Gates are to be closed only during maintenance of the FGD plant and during the opening of the FGD Bypass damper.

3.0 Scope of supply:

Design, Manufacture, Testing, Painting & Packing for Shipment and Assistance for Erection& Commissioning including:

3.1 Guillotine gate assembly (1 No.)with mating flanges on both sides (Upstream & Downstream)

3.2 Electric Actuator

3.3 Seal air system with–

(a)Blower with motor- 1 x 100%,

(b)Heater & its related accessories/ Instrumentation(Refer clause 19.0)

(c) Air operated knife edge gate, or butterfly valve with solenoid valve & air filter regulator and

(d) seal air piping from Blower till seal air opening in Gate frame.(The seal air skid for this gate containing the Blower with Motor, Heater, Isolating valves and all required Instrumentation is in vendor scope of supply and it shall be mounted on platform above the duct. Mounting platform for supporting seal air skid and access ladder alone will be supplied by Purchaser.)

3.4 Leak Tightness Type test(Volumetric flow method) to be conducted on the gate to be supplied for the first unit. Separate Break up price for this type test is to be indicated. (Refer clause no. 12.0)

3.5 Erection & Commissioning support. (Refer clause nos. 6.2, 6.3 & 16.0)

3.6 Mandatory spares (will be covered separately but vendor to quote with breakup price for the following)

(i) 1 set of seals of each type for the Gate (Set means complete Replacement for one gate)

(ii) 1 number Actuator (excluding gear box) for the gate

4.0 Working Environment:

The medium of flow in the gate is corrosive Flue gas and the properties of the medium is enclosed in Clause No.23.

5.0 Operational Requirement:

During start up of boiler both gates(FGD Inlet & Outlet)are in closed condition. When the FGD is ready to operate and ID fans are under normal running condition then FGD inlet and outlet gates are opened by control system. After ensuring 100% opening of both inlet and outlet gates through limit switches, the FGD bypass damper is then gradually closed for diverting the flue gas into the FGD plant for treatment. The

pressure loss along the FGD is about 300 mm of water column. For taking shutdown maintenance of FGD plant, bypass damper is gradually opened, after ensuring 100 percent opening of bypass damper, both gates are allowed to close.

6.0 Design Criteria:

Gates are to be designed to meet the criteria stated below

- Duct inner dimensions 6000mm width x 12007 mm height
- Data sheet for FGD Outlet Gate(DS–57570)
- Flue gas property (Clause no. 23.0).

6.1 ~~Split~~ / modular design: Gate size being large, it is not possible to dispatch as single piece. Hence only modular design Gate shall be supplied. After all applicable testing at vendor's works, this Gate is to be dismantled and packed for transportation. At site, it should be assembled for erection & installing in duct. Vendor has to specify the method of construction & mounting details during the offer.(Refer Clauseno.13.0)

6.2 Site Assembly Scope:

Considering that the Guillotine gate is shipped to project site in knocked down condition, site assembly (including consumables for welding / bolting etc. required for making it into a whole assembly), arranging for all necessary manpower for assembling the Gate at site, special tools, special equipment and special temporary attachments as applicable for safe erection on a rental basis are to be arranged by vendor as part of their scope of supply and the Gate is to be erected to the connecting duct by the vendor at site. However the welding of the gate mating flanges to the upstream and downstream connecting ducts and consumables required for welding the mating flanges of Gate to the Connecting ducts are in Purchaser's scope. Vendor is responsible for the erection of gate in duct and has to estimate the requirements of manpower , their duration at site, the rentals for applicable items required for enabling erection in duct at site and quote suitably.

The above activity has to be done in the first visit i.e. Erection support visit. BHEL will inform the vendor sufficiently in advance when the Erection support (first visit) is required at site. The vendor has to make their own travel to site, boarding and lodging arrangements at / near site during this period including local travel. (Also refer clause 16.0)

6.3 Commissioning support at site:

The vendor has to offer commissioning support at the project site for the offered Gate and its accessories to enable successful completion of all commissioning and operation of applicable interlocks during the second visit of 2 days in site (Commissioning support visit).

BHEL will inform the vendor sufficiently in advance when the Commissioning support (second visit) is required at site.

The vendor has to make their own travel to site, boarding and lodging arrangements at / near site during this period including local travel.

The Bidder has to quote separate Breakup Price lumpsum(including charges of above clause nos. 6.2 and 6.3 meeting requirements of clause no. 16.0) in sl. no. 4 of Proforma Invoice (PI-57570).

7.0 Construction Details:

7.1 Casing:- Casing shall be fabricated to the dimension as per the datasheet with suitable thickness. It shall have a provision for seal air entry duct. Lifting lugs shall be provided for handling. The frame shall be suitably stiffened. The frame depth(face to face) shall be approximately 400mm. Name plate details with Purchase order number, Vendor name, Address & email ID is to be fastened visibly on drive side on the frame. Frame shall have Actuator mounting bracket, blower mounting bracket & seal air piping mounting arrangement.

7.2 Locking device: manual locking device shall be provided both at full open and full close positions.

7.3 Blades:-Blades are designed in such a way that it should have deflection resistant configuration and have suitable thickness to with stand the pressure given in the datasheet.

7.4 Shaft:- Suitable material shall be selected to withstand the high torque.

7.5 Stuffing Boxes: specially designed stuffing box with suitable seal materials.

7.6 Bearings:- suitably designed maintenance free bearing are to be provided.

7.7 Sealing System: Suitable seals are to be installed on the periphery of the gate frame. The gate seals must be rugged enough to withstand when heavy stock of solid slurry crushed in between the blade and seals during the closure. Sealing arrangements shall ensure minimum 99.8% sealing efficiency on flow without seal air and 100% with seal air. Seals shall have minimum service life oft here years before replacement. The seal fixing arrangement on all the four sides shall be clearly specified in the drawing.

8.0 Material of Construction:-

8.1) The Adjoining duct is made up of S–Ten1 material of 9mm thickness.

8.2) Outletgate:

(a) Frame:(For all parts of frame in contact with flue gas)
S-Ten 1 / A36 lined with 5 mm thick SS317LMN or better material / C276 cladding (Refer note regarding cladding below) of sheet thickness 1.6 mm. (The alternate better material should have a higher PREN value compared to SS317LMN when calculated using the chemical composition formula " PREN = *%Cr + 3.3*%Mo + 16*%N "

(b) Blade: (On Upstream side of flow i.e. facing FGD Plant side)
SS317LMN / C276 cladding of sheet thickness 1.6 mm (Refer Note below).

Note: cladding shall be attached properly to the base to ensure that the base material does not come into contact with the corrosive gases under any circumstance.)

8.3) **Seals:-** HASTELLOY Alloy C-276 **(ASTMB575 UNSN10276)**

8.4) Note for Materials offered

If alternate materials are offered like JIS, DIN etc., other than ASTM indicated in our specification/ datasheet, then vendor has to indicate nearest equivalent ASTM material codes in addition to their offered codes with chemical Composition for our review. (Chinese standard for materials are not acceptable). The alternate materials are to be equal or better than those corresponding specified. .
Vendor has to submit justification for these, showing comparison of physical, chemical strength property for the intended part/ service.

9.0 Seal Air system (1x100%)

Seal air is required during closed condition of guillotine gate to avoid leaking of downstream side hot flue gas (i.e. from Bypass duct side) into FGD plant for safe maintenance of the plant. Vendor has to specify, whether seal air is required continuously or only during closed position. Seal air system shall consist of blower with motor, Electrical heater, air operated knife edge gate or butterfly valve with solenoid valve, filter cum regulator and connected piping arrangement (skid mounted) in vendor scope. Vendor to specify the seal air flow, pressure, blower kilo watt rating with the technical offer. The solenoid coil rating shall be 24VDC. Blower selected shall be suitable for 3 phase power supply, 50 Hz & 415V AC. The motors shall be Energy efficient motors, Efficiency class – IE2 conforming to IS12615.(Refer TECI:: LT MOTOR: REV01 for Motor spec of seal air blower) The noise level of Blower with motor at 1.5 meter above floor level & at 1 meter horizontal distance shall not exceed 85dBA. Electrical wiring termination shall be at termination box with double compression type nickel plated brass cable gland with insulated tinned copper crimping lug. Electrical Heater shall be provided to heat the seal air. Vendor shall size the heater suitably to avoid condensation of water vapour on gate blades, ash deposition, to minimize the thermal differential across the gate and to meet the design criteria.

The electric Heater shall heat the seal air to at least 130ºC (The dew point temperature of flue gas)

10 .0 Actuator System: (with Secondary Gear box with splined bush–worm gear & self locking. Also refer Actuator spec TDA: NTPC: DAE: OCIS, Rev.03)

Electric actuator with manual hand operated wheel for manual open/close. The force required to operate manually shall be within 35 kg-f at the wheel rim. Vendor shall

furnish actuator details like make, model, KW rating, output RPM, sizing torque, run torque, stall torque. Actuator is suitable for 3 phase power supply, 50 Hz & 415V AC. The time taken for raising/ lowering gate blade shall not exceed 8 minutes and shall be furnished by the vendor. The actuator shall be equipped with Integral starter, limit switches and positional transmitters(Inductive type).

There is a possibility of fly ash and slurry solid can accumulate on the duct floor, the gate drive system must be sized to provide sufficient power to break through the reasonable amount of deposits.

11.0 Painting requirements: (Also refer PS VINDHYACHAL R549 REV.00 dt. 16/08/2012 , 1 page 11 of 12)

Power tool cleaning to St3 (SSPC-SP3) followed by

i) Two coats of Heat resistant aluminum paint Gr. 2 as per IS 13183 with total film thickness of 40 microns for the gate surfaces.

(ii) Painting is not applicable for stainless steel surface, C276 seals & cladding surfaces

12.0 Quality plan & Testing:

Vender shall submit QUALITY PLAN for approval covering the following:

a) Vender has to submit their QUALITY PLAN (QP) for customer (NTPC) approval. While preparing QP, vendor shall consider BHEL quality requirements as specified in the BHEL quality plan No: **R501/04 dated 30-09-2011** approved by NTPC . The vendor has to follow the same in line with NTPC Manufacturing QP (MQP) taking care of all the applicable clauses and the vendor has to submit the MQP accordingly for NTPC Approval. A sample MQP of a different vendor for a different product is enclosed for reference (1 page) . NTPC will require minimum 3 weeks time to approve the MQP.

b) Vendor has to submit GA drawing of gate assembly showing all important dimensions like overall height, drive shaft & actuator/gear box location. The GA shall include all item details with BOM and material specification. Seal arrangement on all the four sides, blade construction, frame construction & sectional views on all four sides. Actuator location, platform requirement & arrangement for the seal air skid, Seal air entry interface details. Modular details for dispatch. Supplier's drawing should be approved by BHEL / Customer before start of manufacturing by vendor.

c) Detailed test procedure for (i) routine / acceptance test, (ii) Detailed test procedure with test parameters for leak tightness with & without seal air is to be prepared inline with BHEL/Ranipet test procedure No G&D:LTTP and same shall be submitted for customer approval with drawing showing the test set up and sample calculations.

The gate should be tested at manufacturer's works for operation, seal gap measurements and leak tightness without & with seal air to prove the guaranteed sealing efficiency of ≥ 99.8%&100% respectively and report should be submitted. Vendor shall make their own arrangements for test stand, test equipment like blowers, Actuator, Air tanks and instruments. The tests will be witnessed by BHEL and customer or their authorized inspection agency. Leak tightness test Report without seal air and with seal air should be submitted and it has to prove the guaranteed sealing efficiency. The gate is to be dispatched only on explicit clearance by BHEL after review of test records.

For testing the leak tightness, seal air at sufficient pressure above the operating pressure

is to be supplied to ensure 100% leak tightness. Detailed test procedure for leak tightness testing (G&D: LTTP), 7 pages is enclosed. After Purchase Order is placed, vendor shall submit their Test Procedure for Leak tightness test for approval. This has to be the same as that required in BHEL enclosure (G&D: LTTP). Alternate testing procedures(Bidder's counter offer) of leak tightness efficiency by surface area method or seal air consumption method as against volumetric flow specified in the test procedure No G&D:LTPP is not acceptable. Vendor has to give 15 days advance intimation for witnessing of leak tightness type test for making travel arrangement. The gate is to be dispatched only on explicit clearance by BHEL after review of test records.

d) Gate material test certificates and Inspection records.
e) Gate Open and Close testing using actuator
f) NDT requirements of the weld.
g) NTPC Approved painting procedure to be followed.
h) Supplier's drawing should be approved by BHEL before manufacturing.
i) NTPC format evaluation reports enclosed

1) Format No. QS-01-QAI-P-04 / F1-R2 page 1 of 1 which will be filled up by BHEL and submitted to NTPC. This is for Bidder's information.
2) Format No. QS-01-QAI-P-04 / F2-R1 pages 1 to 7 of 7. This has to be filled up and submitted by Bidder along with Technical offer.

13.0 Packing for dispatch:

Gate and accessories are to be painted and packaged to take care of corrosion due to sea voyage and handling at port & site. Packing has to withstand power station outdoor condition for the period of six months.
Packing shall be done in accordance with General shipping instructions.

Sufficient amount of transport stiffeners are to be welded on all the sides of gate to avoid distortion (if applicable) during transit & handling. Stiffeners should be painted yellow. Description, quantity &weight details of each items have to be neatly marked on each crate.

Overall Transportation Limitations for Indian Roads(for guidance)

Width of road transport = 5500 mm maximum
Height of the consignment = 5000 mm maximum
Length of consignment = 20000mm
Weights of the consignment = 40000kg

Vendor shall submit shipping bill of material with packages, identified with overall size, quantity and weight. Overall dimensions shall be as per transport limitations furnished above.

14.0 Qualification Requirement (Offer Acceptance Criteria)

The Bidder to qualify should have engineered and supplied (manufactured by themselves or through their outsourced manufacturers or through their technology licensee) both the following 2 items:

(a) A large size single Guillotine gate of modular (dis-mantlable) design with single electrical actuator meeting the technical requirements of clause 6.1 of this specification for at least 43 m^2 duct cross sectional area. (The duct cross section for this Vindhyachal project FGD Outlet gate being 72.042 m^2 i.e. 6m x 12.007m). For this purpose , reference list of split gates i.e. of 2 or more gates connected by a flow divider to fit a large size duct is not acceptable and will be considered as not qualifying to our Technical requirement.

(b) A Guillotine gate or a Louver Damper with special materials like SS317LMN / C2205/ 904L if the bidder proposes to supply the same for this FGD Outlet gate (or) a Gate / Louver damper with C276 cladding for Blades and Frame if C276 is contemplated by the bidder for this project.

The above 2 items (a) and (b) should have been erected and completed at least 1 year of satisfactory operation as on date of tender opening. If the Bidder has designed and supplied a Guillotine Gate meeting above 2 conditions (a) and (b), then a single reference is sufficient.

(c) The Bidder shall provide their customer reference details for (a) and (b) above showing name of project, date of commissioning and service. Bidder shall also submit General Arrangement drawing for the above showing clearly Bidder / Licensee / Licensor name in title block as applicable, size of gate, BOM for proof of materials for (b) above, Assembled weight and proof that it is of dis-mantlable design as specified in clause no. 6.1 & 14.0 (a).

(d) In case a Licensee is the bidder, the licensee shall furnish a Certificate from the qualified Licensor(meeting the technical requirements of (a) and (b) above, that the bidder is authorized to quote for this project and they will provide the Engineering support to enable the licensee to complete all deliverables indicated in scope of supply clause 3.0, 12.0 and 16.0. Also the reference details and G.A. drawings of the supplies made by the Licensor for (a) and (b) above shall be enclosed.

Non submission of details and back up documents specified in (c) and in the case of a Licensee (c) and (d) above will lead to rejection of Bidder's offer and the same will not be considered for further evaluation.

15.0 Responsibility

The extent of supply stated here in is not necessarily exhaustive and shall not relieve the supplier from his responsibilities to provide goods & services necessary to satisfy the purchaser's performance criteria & required life, to be complete for installation & to be fit for purpose, safe, reliable, easily maintained and efficient in operation.

Bidder shall make all possible efforts to comply strictly with the requirements of this specification and other specifications/ attachments to inquiry/ order.

In general, deviations are not acceptable. In case, deviations are considered essential by the Bidder (after exhausting all possible efforts), these shall be separately

listed in the Bidder's proposal titled as "List of Deviations/ Exceptions to the Enquiry Document". Deviation shall be listed separately for each document with cross reference to Page No./ Para etc. of the respective document supported with proper reasons for the deviation for purchaser's consideration. Any deviation, not listed under the above section, even if reflected in any other portion of the proposal, shall not be considered applicable. No deviation or exception shall be permitted without the written approval of the purchaser.

In case the Bidder considers requirement of additional instrumentation, controls, safety devices and any other accessories /auxiliaries essential for safe and satisfactory operation of the equipment, he shall recommend the same along with reasons in a separate section along with his proposal and include the same in his scope of supply.

16.0 Assistance for Erection & Commissioning:

The Bidder shall quote separate breakup price per diem basis for support to be rendered during erection and commissioning of the gate at the project site. The vendor has to offer erection support in the first visit as indicated in clause no. 6.2 and 2 separate days at site for commissioning in the second visit as indicated in clause no. 6.3. Payment will be made on certification by site engineer on satisfactory completion of both the erection and commissioning support. The vendor has to make their own travel to site, boarding and lodging arrangements at / near site during this period including local travel.

The Bidder has to quote separate Price lumpsum(including charges of above clause nos. 6.2 and 6.3 in sl. no. 4 of Proforma Invoice (PI-57570). Bidder shall indicate lumpsum value and not give counter offer by indicating travel, accommodation, man hour / man day, rental costs etc. in PI-57570.

17.0 Spares:

The Bidder shall offer for the following.

a. Commissioning spares –Quantity with per unit rate
b. Recommended spares for 3 years operation – Quantity with per unit rate

The above will not be included for price comparison between vendors. BHEL reserves the option of procuring any or all of these at a later stage. Prices are to be valid for a period of period of 3 years from offer submission stage. Vendor has to quote for the Mandatory spares indicated in PI-57570.

18.0 Special Tools:

The Gates shall be designed to be assembled, disassembled and maintained with standard hand tools. However, if at all the vendor desires special tools are required, the same has to be supplied along with the Gate. List of special tools if applicable is to be brought out clearly in " SCOPE OF SUPPLY".

19.0 Instrumentation in Vendor's Scope of supply: (Refer P&ID:4610-101-04RP)

- Local Pressure gauge with isolating root valve upstream of Heater.
- Flow switch for Heater protection (connection to FGD DCS by Purchaser)
- Seal Air Heater (3 ph, 415V, 50Hz. Should withstand a variation of ± 10% in Input voltage, ± 5% in frequency and a combined variation of ± 10% and designed for continuous operation.) Control panel is in NTPC scope of supply.
- Temperature switch for Heater Protection (connection to FGD DCS by Purchaser)
- Temperature Transmitter for Heater Protection (connection to FGD DCS by Purchaser)

The Instrumentation / control cables for all the above instruments are to be terminated in Field Junction boxes to be supplied in vendor scope.

The above are in addition to other items specified in clause no. 3 – Scope of supply. Instrument air will be provided at a pressure of 4.5 kg /cm^2(g) for the pneumatic operation of the isolating valve in seal air line. The exact air regulator setting to be furnished by the vendor . Also for the pneumatic actuator of the isolating valve, Instrument air requirements in m^3/sec x __ sec (duration of open / close time) to be furnished by vendor. BHEL will only supply the power and control signals for Gate operation. All accessories & interconnection wiring / tubing and other instrumentation are in vendor scope.

20.0 (A) Auxiliary Power consumption:

The design and material selection of all the Guillotine gate components is to be done such that when the FGD is in operation (i.e. Gate Blade is in open condition), the Electrical heater will be switched off and no component of the Gate shall be corroded. All materials including Frame, Superstructure & Bonnet cover exposed to Flue gas to be taken care to prevent sulfuric acid corrosion when Gate is in open condition. Vendor has to confirm in Check list enclosed that the heater can be switched off when Blade is in open condition. (This will minimize auxiliary power consumption to end user).

When the FGD is not in operation (i.e. Gate Blade is in closed condition), the auxiliary power consumption of heater is estimated at 225 KW considering the Ambient air temperature of 27 deg C & 60% Relative humidity and heated to 130 deg C. The seal air blower power consumption is estimated as 20 KW for both FGD in operation & FGD bypassed. The total auxiliary power consumption in FGD Bypass mode is 245 KW(i.e. 225 + 20).In the technical offer, if the bidder's power consumption in FGD bypass mode exceeds 245 KW, a price loading @ Indian Rupees 2,25,000/- per KW increase above 245 KW will be added to the vendor's quoted price for price comparison purpose between different vendors. Hence bidder shall consider auxiliary power consumption values carefully for equipment selection. However bonus / preference is not applicable if the vendor's quoted auxiliary power consumption is less than 245 KW.

(B)Operating pressure for this Gate in mm WC:

Upstream side of Gate : FGD plant (Refer Key plan drg in Clause 22.0)

Downstream side of Gate : Bypass duct from Boiler to Chimney

	When Gate open	When Gate closed
Upstream pressure mm WC Upstream Temp deg C	10 to 40 approx 100 to 105	0 Ambient
Downstream Pressure mm WC Downstream Temp deg C	10 to 40 approx 100 to 105	10 to 40 approx 130 to 145 deg C

21.0 DOCUMENTS:

Vendor shall submit the following documents and drawings in English

21.1 Documents to be submitted along with Offer.

Sl.no:	DOCUMENTS	Vendor Acceptance comments/
1	(i) Comments/deviation for the Specification No. GDRS 017 & related enclosures (ii) Filled up Data sheet for Gate: DS-57570 (iii) Filled up Data sheet for Electrical actuator: TDA: NTPC: DAE: OCIS. Rev03 (pages 11 to 14) (iv) Filled up Proforma Invoice (Un-Priced Price Bid) : PI-57570 (v) Filled up Checklist : CL-GT-57570	
2	General arrangement drawing with dimensions showing location of Accessories like Blower, Heater, Isolation valve, Actuator, Gear Box, BOM & Weight.	
3	Vendor quality plan for review (should be in line with BHEL Quality Plan)	
4	Recommended spares list for commissioning & three year operations	
5	Reference list of FGD gate– (as per Clause no.14.0)	
6	Vendor confirmation for all documents submission in 21.2, 21.3 & 21.4 for approval as specified after placement of purchase order	
7	Draft Erection & Commissioning Procedure applicable for the offered design and scope of supply.	

21.2 Vendor shall submit the following Documents for BHEL approval within 30 days after placing Purchase Order. Only after BHEL Approval, vendor can commence manufacturing activity.

SlNo	Documents	No Copies required	Vendor acceptance comments / deviation
1	Revised Quality plan(if any)	1	
2	Test Setup & procedure for Leak tightness test	1	
3	Final gate Datasheet	1	

4	Final Actuator data sheet	1	
5	Basic engineering transmittal for approach and platform for maintenance	1	
6	G.A Dimensions and Mounting details of Gate/ Damper and its Accessories, End to end dimensions of Gate with mating flanges, Skid mounting details / Layout arrangement of seal air skid (To enable BHEL design & supply platform for skid mounting & ladder for access), P&IDs, Power & Control schemes	1	

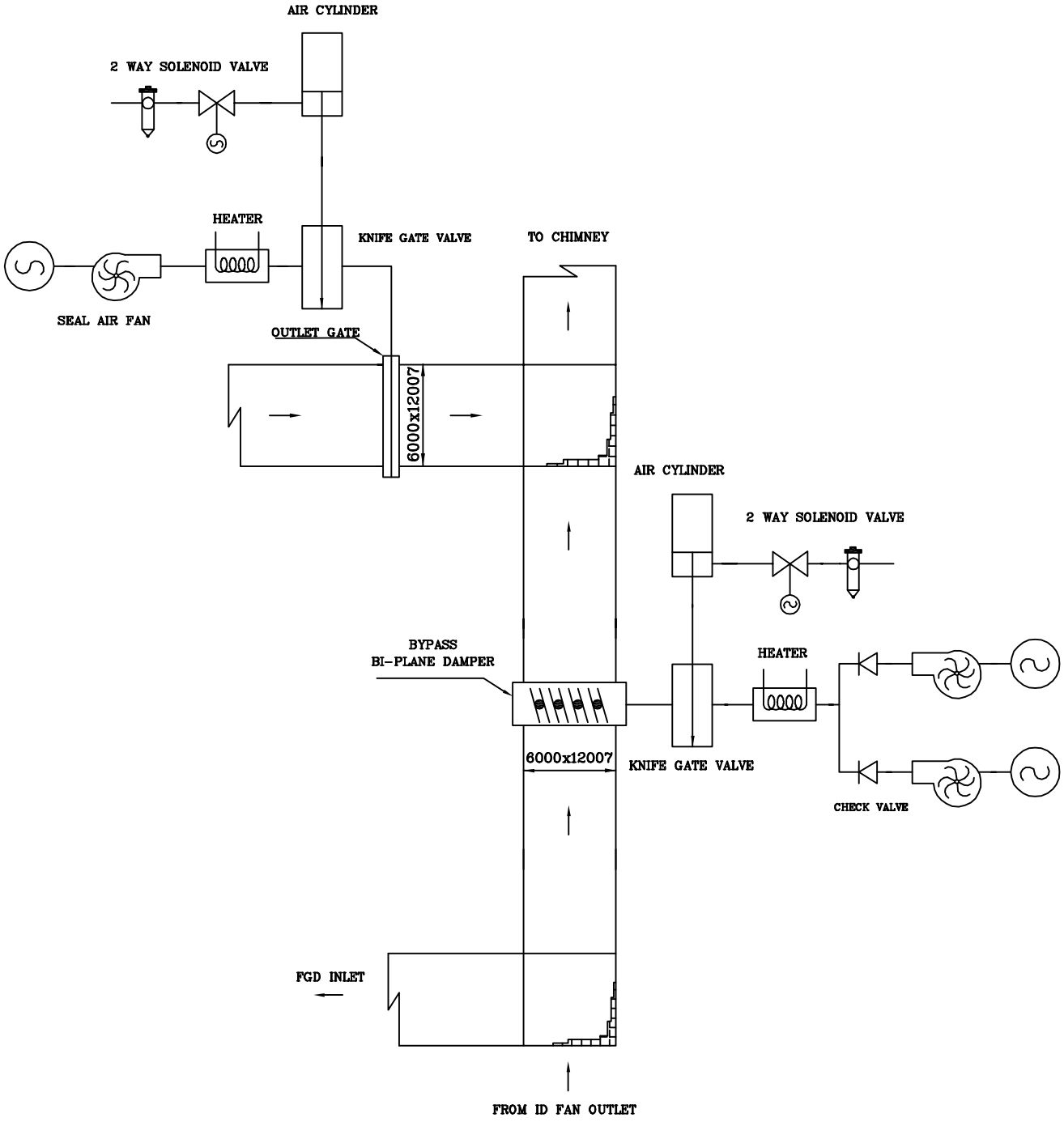
21.3 Documents to be submitted before dispatch

Sl. No.	Documents	No Copies required	Vendor acceptance comments / deviation
1	Complete inspection/ test records of gates & accessories.	2	
2	Leak test results with & without seal air	2	
3	Raw material Test Certificates	2	
4	Packing drawing & specification	2	
5	Erection drawing & Erection manual(in English for gate, Actuator & all accessories)	3	
6	Protection / Interlocks, Operating Procedures / Trouble shooting & Maintenance etc.	3	

21.4 Documents to be submitted along with Dispatch

Sl. No.	Documents	No Copies required	Vendor acceptance comments / deviation
1	Shipping list / supply schedule	3	
2	List of spares dispatched	3	
3	O&M manual (in English for gates & Actuator)	3	

22.0 Key plan drawing of the FGD Gates & By pass Damper



23.0 FLUE GAS Property

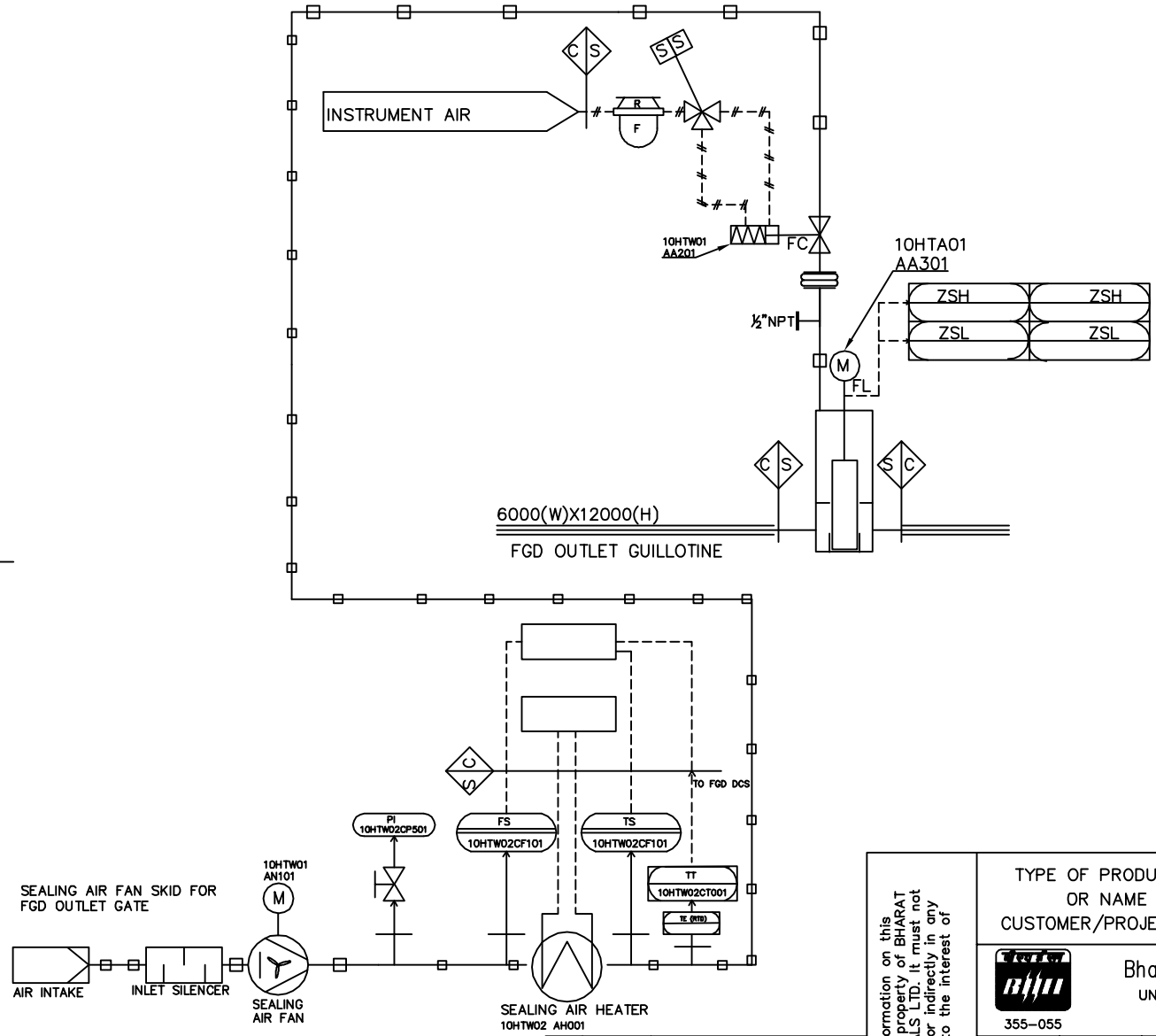
Sl.No	Item Description	Unit	Values (Worst coal)
01	Inlet dust concentration to FGD	mg/Nm^3	50 - 200
02	SO_2 concentration at FGD inlet gate	mg/Nm^3	GP -1912 DP -1852
03	SO_2 concentration at FGD outlet gate	mg/Nm^3	GP – 180 DP - 178
04	Flue gas flow through Gate / Damper	Nm^3/s	GP – 565.6 DP – 643.3
05	Density of flue gas	Kg/m^3	0.784
06	Inlet SO_2	%(byvol)	0.07
07	SO_3	%	1.5% (conversion from $SO_{2)}$
08	SO_2 removal efficiency	%	GP – 90.6 DP – 90.4
09	Moisture (wet basis)	%(by vol)	GP – 13.61 DP – 16.06
10	Flue gas temperature at FGD inlet	Deg. Centigrade	GP – 125 DP - 145
11	Flue Temperature of gas at FGD outlet gate	Deg. Centigrade	100
12	Ambient Air temperature	Deg. Centigrade	GP – 27 DP - 42
13	Relative humidity	%	60

Note: GP : Guarantee Point ; DP – Design Point

The Leak tightness type test is to be done for the Design Point parameters indicated.

DRAWING NO: 4610-101-04RP

NOTE: –
(1).QTY SHOWN FOR 1(ONE) SYSTEM.
TOTAL OF 1(ONE) SYSTEM REQUIRED.



PIPE LINE SYMBOLS: –

- FLUE GAS DUCT LINE
- SEAL AIR LINE
- INSTRUMENT AIR OR PNEUMATIC SIGNAL
- INSTRUMENT PROCESS PIPING OR CONNECTION TO PROCESS
- HYDRAULIC LINE
- ELECTRICAL SIGNAL
- MECHANICAL LINK
- S C — BATTERY LIMIT SUPPLIER/ CUSTOMER

△01 LEGEND: –

PI – PRESSURE GAGE/ INDICATOR
FS – FLOW SWITCH
TS – TEMPERATURE SWITCH
TT – TEMPERATURE TRANSMITTER
TE – RTD
RF – AIR FILTER REGULATOR
SS – DUAI COIL SOLENOID VALVE

REV	DATE	ALTERED : SARAN
01	10.10.14	CHD & APPD: D.ASHWIN
ZONE △01		LEGEND ADDED

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT

Bharat Heavy Electricals Ltd
UNIT: BOILER AUXILIARIES PLANT
RANIPET – 632 406
355–055

	NAME	SIGNATURE	DATE
DRN	NEELA		10.09.13
CHD	ASHWIN		10.09.13
APPD	ASHWIN		10.09.13

DEPT / CODE	ALL DIMENSIONS ARE IN MM	PROJECTION	SCALE	WEIGHT (Kg)	REF TO ASSY / OLD DWG

TITLE: P&ID of FGD OUTLET GATE and SEAL AIR PIPING

DRAWING NO : 4610–101–04RP | REV 01

भेल BHEL Ranipet	MANUFACTURER'S NAME AND ADDRESS **M/S BHEL RANIPET 632 406 TAMIL NADU**	ITEM /EQUIPMENT: **G&D** SUB-SYSTEM: **GUILLOTINE GATE ASSY.**	QP NO / REV/ DATE / PAGE NO	**R501** / **04/30 09 11** / **1 OF 5**	**SIGN. OF MFGR'S** P. KARTHIKEYAN MANAGER / QA	NTPC **TO BE FILLED BY NTPC**: QP NO.: **0000-999-QVM-P-267**; REV NO/DATE: **03/DT 30092011**; PAGE NO.: **1 of 5**; VALID UP TO 29.09.2014; REVIEWED BY; APPROVED BY

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK M	QUANTUM OF CHECK C/N	REFERENCE DOCUMENT#	ACCEPTANCE NORMS	FORMAT OF RECORD	D	AGENCY M	AGENCY C	AGENCY N	REMARKS
1.	2.	3.	4.	5.	6.		7.	8.			** 10.			11.
1.0	**Raw material**													
1.1	Plates, Rolled sections	Chemical & Mechanical Properties	Major	TC Verification	100%	@@	Material specification as per GMS.	TC		P	V	V	
		Soundness (UT) #	Major	Do	100%	@@	ASTM A 435	TC	√	P	V	V	
1.2	Rounds	Chemical & Mechanical properties	Major	-DO-	100%	@@	Material specification as per GMS.	TC		P	V	V	
		Soundness (UT) #	Major	Do	100%	100%	ASTM A 388 /AM 203.2 of ASME Sec VIII Div 2	TC	√	P	V	V	
1.3	Seals to ASTM B575 UNS N10276 ##	Chemical &Mechanical properties	Critical	-DO-	100%	##	As per TDC: 304 Rev.00	TC	√	P	V	V	
1.4	Sprockets IS 210 FG 300, ASTM A 48 ##	Mechanical Properties	Major	-DO-	100%	##	As per Material specification	TC		P	V	V	
1.5	Sub deliveries	Conformance to PO	Major	Do	100%	100%	Note 3	TC		P	V	V	

TC - Test Certificate

@@

- Specification of material referred in QP is indicative only. Actual material shall be as per GMS.
- Review of material TCs shall be for plates above 40 mm thickness only. For plates of thickness less than or equal to 40 mm, COC will be submitted by BHEL to NTPC
- TC verification of channels of size 400 mm and above (if applicable) and Beams of Size 450,500 and 600 mm.
- # Plates of thickness more than 40 mm and Rounds of Dia. more than 50 mm shall be UT tested.
- ## Surveillance checks of TC verification will be carried out at Raw materials.

LEGEND: * RECORDS, IDETIFIED WITH **"TICK" (√)** SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** **M:** MANUFACTURER/SUB-SUPPLIER **C:** MAIN SUPPLIER, **N:** NTPC **P:** PERFORM **W:** WITNESS **V:** VERIFICATION. AS APPROPRIATE, **CHP:** NTPC SHALL IDENTIFY IN COLUM "N" AS 'W'

Note: # NTPC Inspection Engineer to check, Approval Date/Revision No .of reference documents at the time of inspection

MANUFACTURER'S NAME AND ADDRESS	ITEM /EQUIPMENT:	QP NO	R501	SIGN. OF MFGR'S	TO BE FILLED BY NTPC			
M/S BHEL RANIPET 632 406 TAMIL NADU Ranipet	**G&D** SUB-SYSTEM: **GUILLOTINE GATE ASSY.**	REV/ DATE	04/30 09 11	P. KARTHIKEYAN MANAGER / QA	QP NO.: 0000-999-QVM-P-267	REVIEWED BY	APPROVED BY	
		PAGE NO	2 OF 5		REV NO/DATE 03/DT 30092011			
					PAGE NO.: 2 of 5			
					VALID UP TO 29.09.2014			

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT#	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					M	C/N					M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.		D	** 10.			11.
2.0	**In process Control**													
	Welders are Qualified to AWS D1.1. Procedures are pre qualified & NTPC will review procedures and welders qualification records													
2.1	Weld Inspection	Weld Quality & Size	Major	Visual & Measurement	100 %	100%(C) 10% (N)	Note – 1		Report		P	W	V	
2.2	Welds on T-bar with gate plate , Collar on shaft and Blower Mounting Bracket	Weld Soundness	Major	LPI	100%	100%	Drawing & BHE: NDT: RP: PT 01/02		Report	√	P	W	V	
2.3	Welds on Mounting Bracket , Splice joints of gate plate & all other welds	Weld Soundness	Major	MPI / LPI	100%	100%	Drawing & BHE: NDT: RP: PT 01/02 BHE : NDT: RP: MT 01/02		Report	√	P	W	V	
2.4	Butt Joint welds of gate frame	Weld Soundness	Major	MPI	100%	100%	Drawing & BHE: NDT: RP: MT 01/02		Report	√	P	W	W	
2.5	Assembly	Overall Dimensions & Match marks	Major	Measurement	100%	100%	Drawing		Report.		P	W	V	
3.0	**Final inspection**													
3.1	Trial operation	Free operation.	Major	Open and close Movement	100%	100%	Drawing & Note 2 (j)		Report	√	P	W	W	
3.2	Performance Leak Tightness Test	Leak Tightness Test (as per contract)	Major	Performance Testing	Refer Test Schedule	Refer Test Schedule	NTPC Engg approved test procedure and Damper testing schedule & **# Witness by NTPC Engg**		Report	√	P	W	W #	

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Note: # NTPC Inspection Engineer to check, Approval Date/Revision No .of reference documents at the time of inspection

Ranipet	MANUFACTURER'S NAME AND ADDRESS **M/S BHEL RANIPET 632 406 TAMIL NADU**	ITEM /EQUIPMENT: **G&D** SUB-SYSTEM: **GUILLOTINE GATE ASSY.**	QP NO	**R501**	**SIGN. OF MFGR'S** P. KARTHIKEYAN MANAGER / QA	**TO BE FILLED BY NTPC**		**REVIEWED BY**	**APPROVED BY**
			REV/ DATE	**04/30 09 11**		QP NO.:	**0000-999-QVM-P-267**		
			PAGE NO	**3 OF 5**		REV NO/DATE	**03/DT 30092011**		
						PAGE NO.:	**3 of 5**		
						VALID UP TO	29.09.2014		

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT#	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					M	C/N					M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.		D	** 10.			11.
3.3	Verification of completion	Over all dimension, Orientation, data folder compilation	Major	Verification / Visual	100%	100%	As per drawing All identified by" √" "under D " in QP		Report.	√	P	W	V	
3.4	Painting, preservation & protection.	Finish	Minor	Visual	100%	10%	Drawing		Report		P	W	V	
		Paint DFT	Major	Measurement	Random	Random	As per NTPC approved Painting scheme		Report		P	W	V	
	Identification	WO No., DU & Project	Minor	Visual	100%	Random	Drawing and GMS		--		P	V	V	

NOTE 1: VISUAL INSPECTIONS

a) Visual inspection of welds shall be performed after completion of welding on shaft, Blower air mounting brackets welds to be witness by BHEL & verification of reports by NTPC
b) All welds shall be cleaned to remove slag, spatter etc and visually examined for defects like crack, undercut, porosity, lack of fusion etc.
c) The welds shall also be examined for size, shape and re-inforcement.

Nature of defects	Acceptance Norms	Disposition
Crack, lack of fusion, overlap	Not accepted repair and retest.	Confirm by LPI/MPI.
Crater	Not accepted	Fill by weld deposit
Undercut	Up to 0.8 mm accepted. >0.8 mm not accepted	------- Fill and grind smooth
Porosity for butt/fillet welds	One pore of dia < 2.4 mm every 100 mm length is permitted. However pores of dia > 2.4 mm not accepted.	-------- To be repaired.

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Note: # NTPC Inspection Engineer to check, Approval Date/Revision No .of reference documents at the time of inspection

Ranipet	MANUFACTURER'S NAME AND ADDRESS **M/S BHEL RANIPET 632 406 TAMIL NADU**	ITEM /EQUIPMENT: **G&D** SUB-SYSTEM: **GUILLOTINE GATE ASSY.**	QP NO	**R501**	**SIGN. OF MFGR'S** P. KARTHIKEYAN MANAGER / QA	NTPC	**TO BE FILLED BY NTPC**	
			REV/ DATE	**04/30 09 11**		QP NO.:	**0000-999-QVM-P-267**	**REVIEWED BY** / **APPROVED BY**
			PAGE NO	**4 OF 5**		REV NO/DATE	**03/DT 30092011**	
						PAGE NO.:	**4 of 5**	
						VALID UP TO	29.09.2014	

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					M	C/N					M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.		D	** 10.			11.

Weld contour

1.Face of fillet	Flat or concave accepted. Slightly convex also accepted provided convexity < 0.1 S + 1.5 mm where S is fillet size.
2. Size (Minimum)	As per drawing. Under size permitted up to 1.6 mm for a cumulative length of 10% of total length.
3 Re-inforcement	Max 3 mm up to 19 mm. , Max 5 mm above 19 mm.

NOTE 2 : GATE FINAL INSPECTION :-

a) Position the Gate in the Testing Stand maintaining verticality on sides & face (flow direction). It shall not have any twist.

b) Set the torque required for ambient operation of the Gate as in the actuator date sheet. In case minimum torque setting available in the actuator is more than no load torque, set on torque at this minimum value.

c) Gate shall be operated with actuator for 5 complete cycles (with an idle time of 10 minutes in between every two cycles)

d) Record amperage, voltage, time taken for each stroke in case of electrical actuator and record air pressure and time for Pneumatic actuator

e) During the test ensure that gate plate is operating freely without rubbing the throat support beam/structural members.

f) Normal running current shall not exceed the permitted value. In case, the current drawn at no load is more than the acceptable value, the same shall be referred to BHEL Engg / C& I for approval.

g) The gate shall be visually inspected for any major damage to blades, seals etc. Ensure the gate plate is in open position. Provide the lock tab and lock it.

h) Set the blade stopper bracket on beam and ensure the stroke length of blades and corner closing.

i) Provide chain guards in position. Provide drain holes in frame and dust guard on super structure.

j) Gate testing ie., open/close shall be carried out with job actuator or with equivalent actuator (ie., approved make, pneumatic, electric, same type, size & rating).

NOTE 3 : SUB DELIVERIES :-

a) For electrical actuators refer the NTPC approved RQP.

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Ranipet	MANUFACTURER'S NAME AND ADDRESS **M/S BHEL RANIPET 632 406 TAMIL NADU**	ITEM /EQUIPMENT: **G&D** SUB-SYSTEM: **GUILLOTINE GATE ASSY.**	QP NO **R501** REV/ DATE **04/30 09 11** PAGE NO **5 OF 5**	**SIGN. OF MFGR'S** P. KARTHIKEYAN MANAGER / QA	TO BE FILLED BY NTPC QP NO.: **0000-999-QVM-P-267** REV NO/DATE **03/DT 30092011** PAGE NO.: **5 of 5** VALID UP TO 29.09.2014	REVIEWED BY	APPROVED BY

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					M	C/N					M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.		D	** 10.			11.

b) For all other items like, chain, Isolation valve, limit switches, Actuator, Check valve, filter cum lubricator, solenoid valve, Bearings, adjusting bolt, Air cylinder, Manual operators and fasteners etc. Refer the categorization III List finalized with NTPC.BHEL will inspect as per Specification and dispatch.

RECORD OF REVISIONS

Record of revision	Revision Number	Date	Basis for change
	00	19 04 2003	Original Issue
	01	30 09 2004	Revised based on discussion with NTPC minutes of meeting Dated 11 09 04
	02	24 01 2005	Revised based on NTPC comments (Format Modified)
	03	17 05 2008	NO change in the RQP. Revised for extension of the Validity period only.
	04	30 09 2011	Note 1 details included in main QP under clause no. 2.0 and other Notes re-numbered and re-submitted for validity date extension

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MANUFACTURER: M/S ECE INDUSTRIES LIMITED A-20, INDUSTRIAL AREA, MEERUT ROAD, GHAZIABAD- 201 001	MANUFACTURING QUALITY PLAN ITEM : ELEVATOR :	QP NO.: MQP 1963/1964 R0 REV.NO.: 0 DATE: 30/04/2013 PAGE: 1 OF 9. JOB NO. : SBA 1963 71964	PROJECT: NTPC BHAR STPP STAGE 2 UNIT 1 &2 PACKAGE: ESP CONTROL ROOM PACKAGE CODE : P O NO. :4223230 DATED 01/03/2013 MAIN SUPPLIER : BHEL RANIPET

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK M	QUANTUM OF CHECK C / N	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	D *	AGENCY M	AGENCY C	AGENCY N	REMARKS
1.	2.	3.	4.	5.	6.		7.	8.	9.		** 10.			11.
1	CASTING	VISUAL	MAJOR	VISUAL	100%		ECE STD	ECE STD			P	V		
	(A) TRACTION	DIMENSIONAL	"	MEASURMENT	100%		ECE STD	ECE STD			P	V		
	SHEEVE	HARDNESS	"	MEASURE	1/HEAT		IS 210/APD DRG	IS 210/APD DRG	MTC	√	V	V	V	
	GRADE – FG 350	CHEMICAL	"	ANALYSIS	1/HEAT		IS 210/APD DRG	IS 210/APD DRG	MTC	√	V	V	V	
		MECHANICAL	"	ANALYSIS	1/HEAT		IS 210/APD DRG	IS 210/APD DRG	MTC	√	V	V	V	
	(B) OVERSPEED	VISUAL	MAJOR	VISUAL	100%		ECE STD	ECE STD			P	V		
	GOVERNOR	DIMENSIONAL S	"	MEASURMENT	100%		ECE STD	ECE STD			P	V		
	WHEEL	CHEMICAL	"	ANALYSIS	1/HEAT		IS 210/APR DRG	IS 210/APR DRG	MTC	√	V	V	V	
	GRADE --FG 200	MECHANICAL	"	ANALYSIS	1/HEAT		IS 210/APR DRG	IS 210/APR DRG	MTC	√	V	V	V	
		HARDNESS	"	MEASURE	1/HEAT		IS210/APR DRG	IS210/APR DRG	MTC	√	V	V	V	
	© DIVERTOR PULLY	VISUAL	MAJOR	VISUAL	100%		ECE STD/	ECE STD			P	V		
	GRADE -FG 200	DIMENSIONAL	"	MEASURMENT	100%		ECE STD	ECE STD			P	V		
		CHEMICAL	"	ANALYSIS	1/HEAT		IS 210/APR DRG	IS 210/APR DRG	MTC	√	V	V	V	
		MECHANICAL	"	ANALYSIS	1/HEAT		IS 210/APR DRG	IS 210/APR DRG	MTC	√	V	V	V	
		HARDNESS	"	MEASURE	"		"	"	MTC	√	V	V	V	

SAMPLE FORMAT

MANUFACTURER	MAIN-SUPPLIER
SIGNATURE	

LEGEND: * RECORDS, INDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION
** M: MANUFACTURER/SUB-SUPPLIER C: BHEL/BHEL NOMINATED AGENCY, N NTPC
P: PERFORM W WITNESS AND V: VERIFICATION AS APPROPRIATE, R REVIEW IR INSPECTION REPORT MTC MANUFACTURERS TEST CERTIFICATE
CHP: NTPC SHALL IDENTIFY IN COLUM "N" AS " W"

FOR NTPC USE

DOC. NO.:	REV..... CAT.....	
REVIEWED BY	APPROVED BY	APPROVAL SEAL

MAIN CONTRACTOR'S EVALUATION REPORT
(For Proposed Sub-Supplier)

1. MAIN CONTRACTOR : : M/S_____

2. PACKAGE & PROJECT NAME : _____

3. BRIEF SPEC. OF EQUIPMENT / ITEM / PROCESS WITH MODEL / TYPE/ RATING / CAPACITY/ SIZE/ TONNAGE ETC. (AS APPLICABLE) : _____

4. PROPOSED SUB-SUPPLIER'S NAME & WORKS ADDRESS : _____

5. BASIS OF RECOMMENDATIONS:

a) Main contractor's own supply experience

REFERENCE LIST (EXPERIENCE FOR THE PARTICULAR TYPE OF EQUIPMENT / ITEM /PROCESS) OF MAIN CONTRACTOR:

CUSTOMER NAME, PROJECT NAME	TYPE / RATING / MODEL/ CAPACITY/ SIZE / TONNAGE ETC (AS APPLICABLE)	SUPPLIED QUANTITY	DATE OF SUPPLY	NO. OF YEARS IN OPERATION/ DATE OF COMMISSIONING (*)

b) In absence of own supply experience:

ENCLOSE MAIN CONTRACTOR'S ASSESSMENT REPORT AS PER THEIR VENDOR APPROVAL SYSTEM (**)

NAME : _____ DESIG. : _____ SIGN : _____ Date: _____

List of Encl.: (Pl. Tick)

(*) a. User Certificate ☐

(**) b. Self Assessment Report ☐

SUB-SUPPLIER QUESTIONNAIRE
(To be filled in by the Proposed Sub Supplier)

Name of Equipment / Item / Process with Model/ Type/ Rating / Capacity/ Size/ Tonnage etc. (As applicable):

_____

Trade Name of Product (if any) : _____

_____

1. **Name of Proposed Sub-Supplier**: _____

   Website: _____

2. **Address of Regd. Office:** **Details of contact person:**
   _____ Name_____
   _____ Mobile no._____
   _____ Desig._____
   E-mail:

3. **Branch/ Liaison office in Delhi/NCR**
   Details of contact person:
   _____ Name_____
   _____ Mobile no._____
   _____ Desig._____
   E-mail:

   Weekly off day _____

4. **Address of Works where Item is being manufactured** **Details of contact person:**
   Name_____
   _____
   _____ Mobile no._____
   _____ Desig._____
   E-mail:

5. **Details of Proposed Works:**

a. Year of Establishment of present works : _____
b. Year of Commencement of Manufacturing at the above works : _____
c. Details of change in works address in past, if any : _____

d.. TotalArea / Covered Area : _____
e. Details of covered area like no. of sheds, Area of each shed etc. _____
f. Electric power- Connected load: _____
Electric power- Stand by load & system: _____

6. **Annual Turnover & Profit in past three years** : _____
_____
_____

7. **Do you have in-house Department for:**

a) Design Yes/No
b) Research & Development Yes/No
c) Quality control/Inspection Yes/No
d) After Sales Service Yes/No

8. **Shift works per day** One/Two/Three

9. **Present Manpower Status:**

Division Status	**Graduate**		**Diploma**	**Skilled**	**Un-Skilled**	**Remarks**
	Technical	**Non-Technical**				
Design						
Production						
Quality Control/ Inspection						
After Sales Service						

a. Organization chart of the proposed works is enclosed as Annexure: _____
b Organization chart of QA / QC Deptt. is enclosed as Annexure: _____
c. List of Qualified Welders with process etc. is enclosed as Annexure: _____
d. List of Qualified NDT personnel with area of specialization is enclosed as Annexure: _____

10. **Brief details of items manufactured:**

Sl. No.	Item & Material (Type/Size/Rating/Model/ Capacity /Tonnage , as applicable)	Installed Capacity	Annual Production Capacity	Annual Production for last Three years		
				I	II	III

11. **Details of foreign Collaboration, if any:**

Sl. No.	Product	Name & Address of Collaborator	Collaboration		
			Scope	Year	Valid upto

12. **Type Test report for the proposed product (similar or higher rating)if applicable is enclosed as Annexure: _____**

13 **Approval / Certification by National / International standards / Accredited agency for the proposed product (if applicable) is enclosed as Annexure: _____**

14. **Statutory / mandatory certification for the proposed product (if applicable) is enclosed as Annexure: _____**

15. **Supply Experience list of the proposed product (similar or higher rating) is enclosed as Annexure: _____**

[List shall include Item description, (Type/Size/Rating/Model/Capacity/Tonnage, as applicable), Customer name, Quantity, Year of Supply and Year of commissioning]

16. **End User's operational feedback certificate for the proposed product is enclosed as Annexure**: _____

17 **List of equipment & machinery specific to the proposed product is enclosed as Annexure: _____**

(List shall include name of equipment, capacity & nos. etc.)

18. **Process Flow Diagram indicating in-house & outsourced process enclosed as Annexure:_____**

19 **General manufacturing facilities available in-house**:

Sl. No.	**Description of machine**	**Type /Capacity / Size / Rating etc as applicable**	**Number**
a)	Material Handling Mobile Crane Fork Lift Over Head Cranes		
b)	Metal Cutting & Bending		
c)	Casting		
d)	Forging		
e)	Fabrication		
f)	Welding		
g)	Machining		
h)	Heat Treatment		
i)	Surface Cleaning Sand Blasting Shot Blasting Pickling		
j)	Painting		
k)	Metal Coating		

l)	Packing		
m)	Other, if any		

20.

a**. Inspection & Testing Facilities available in-house:**

Sl. No.	Description	Capacity & Nos.	Make & year of Mfg.	Calibration Status	Validity period

b. List of Testing & Inspection Facilities outsourced, if any with Source of testing and Description enclosed as Annexure: _____

21. **Storage of finished goods (covered / open) :** _____

22 **List of the source / make with location of major raw material, bought out items and out sourced process enclosed as Annexure:** _____

23. **Quality management:**

23.1 **General**

23.1.1. Work Instruction for different processes available. (Y/N). ___

If yes, enclose list as Annexure_____

23.1.2. Evaluation system for raw material/bought out item's supplier is available. (Y/N) _____

23.1.3. Records generated during inspection maintained & available for review (Y/N) _____

23.1.4 Statistical quality control techniques used (Y/N) _____

23.1.5 ISO certificate for the works available (Y/N). ____ If yes, enclose copy as Annexure_____

23,2 **Corrective action**

23.2.1 Specifically confirm whether System for identification & disposition of Non Conformity in the process / product is available. (Y/N) _____

23.2.2 Specifically confirm whether System for Customer complains & their satisfactory disposal is available. (Y/N) _____

23.3. **Documentation Control**

23.3.1 Procedure available for documentation control (Y/N) ___

23.4. **Control of Inspection, Measuring & Testing equipments**.

23.4.1 Procedure for calibration of testing & measuring instrument available. (Y/N) ___

24**.** Any Special Information**:** _____

26. **I CERTIFY THAT THE INFORMATION SUPPLIED HEREIN (INCLUDING ALL PAGES ATTACHED) IS CORRECT TO THE BEST OF MY KNOWLEDGE.**

SEAL

SIGNATURE_____
NAME_____
DESIGNATION_____
MOBILE NO _____
EMAIL _____

M/S._____
PLACE_____

DATE_____

LIST OF ENCLOSURE:

Certification by Main Supplier: Above information have been verified and found in order / minor changes which have been marked and initialed on this form itself / observed the following discrepancies.

Name : _____ **Designation :** _____**Signature :** _____**Date :**_____

NOTE :

1. ***COLUMN SHALL NOT BE LEFT UNFILLED..IN CASE OF NOT APPLICABLE / NOT AVAILABLE, THE SAME SHALL BE INDICATED IN THE PROVIDED SPACE.***

2. ***IN CASE PROVIDED SPACE IS NOT ADEQUATE, INFORMATION SHALL BE PROVIDED AS AN ATTACHMENT.***

3. ***PRODUCT CATALOGUE FOR THE PROPOSED EQUIPMENT/ITEM/PROCESS,IF AVAILABLE, SHALL BE ENCLOSED***

PS VINDHYACHAL R549 REV.00. dt. 16/08/2012

Sl No	Surface Location	PGMA	Surface Preparation	Primer		Finish		Total DFT in (µm) min.
				Paint	DFT (µm) min.	Paint	DFT (µm) min.	

IV Gates and damper

01	Gates and Damper more than 95 Deg Centigrade	57 XXX	Power Tool Cleaning to St3 (SSPC-SP3)	Heat Resistant Aluminum Paint Gr 2 to IS 13183 (Two coats)	40	--	-	40
02	Gates and Damper less than 95 Deg Centigrade NOT APPLICABLE	57 XXX	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744(Two Coats)	40	Synthetic Enamel to IS 2932 Grey shade 692 of IS 5 (Two Coats)	40	80
03	Items other than in SL No 03	57 466	DO	DO	40	Synthetic Enamel to IS 2932 Grey shade 692 of IS 5 (Two Coats	40	80
	Hand rails, Floor Grills	57 466	Hot dip Galvanizing to 610 gm per Sq.M (Minimum) and to a coating thickness of 87 microns (min)					

General Notes:

1) No painting is required for Galvanized items, non-ferrous items.& stainless steel items , except as indicated above.
2) Machined items are to be applied with one coat of temporary rust preventive oil.
3) PGMAs under sub-vendor items viz SCAPH, Pent house ventilation fan & its coupling, seal air fan coupling, support bearing and sub delivery components of ESP,etc are not indicated .However the Painting schedule for all items supplied by all sub vendors and BOI under the scope of BHEL shall be same as for main equipment covered in this document.
4) In components, wherever plates /sheets of thickness less than or equal to 5 mm and rods are used, power tool or hand tool cleaning to SSPC-SP3/SP2 shall be followed.
5) Ground shade/colour of finish paints and identification tag/band for equipments, Fans, piping, pipe services, supporting structures and other components shall be followed as per NTPC doc at site
6) All components covered under different PGMAs are to be painted. Incase any component is left out, the same shall be deemed to be included under the relevant section

Page 1 of 1

TITLE : TECHNICAL SPECIFICATION FOR BOUGHT OUT ITEMS

ITEM : LT MOTOR

Project : BHEL standard

	NAME	DESIGNATION	SIGNATURE	DATE
PREPARED	**K S S MANIAN**	**Sr Addl Engr**		29.5.14
CHECKED	**S RANGARAJAN**	**S D G M**		29.5.14
APPROVED	**S JAYAPRAKASAM**	**A G M**		**29.5.14**

ISSUED BY **EDC ECI**

Record of revision

REVISION NO : 01 **CI 2.1 Reviewed & Revised**

REVISION NO : 00 **INITIAL RELEASE : 19.3.2013**

Based on TDC TCI 140 Rev 08 & TFN LTM rev 05

Cl No.	CHARACTERISTICS	REQUIREMENT	VENDOR COMPLIANCE (Refer Note: 2)
1.0	SITE CONDITIONS		
1.1	Altitude above mean sea level	➢ 1000 m.	
1.2	Ambient temperature condition	6 to 50°C.	
1.3	Relative humidity	100 %	
1.4	Atmosphere	Tropical ,Dusty, salty, corrosive & highly polluted in a coal based Thermal power plant.	
2.0	GENERAL		
2.1	Reference standards	IS 325, IS 1231, IS 4722, IS 6362, IS 2253, IS 12065, IS 12075 , IS 4691 **& IS 12615-Energy efficient**	
2.2	Design ambient	50 Deg C	
2.3	Application/ Type(Normal/ Energy efficient)	**As per Enquiry & PO.**	
2.4	Duty cycle	Continuous S1	
2.5	Rated voltage, frequency & Phases	415 V AC ±10%; 50 Hz ± 5%;(PI check enquiry for voltage) 10% absolute sum - 3 phase	
2.6	Minimum starting voltage	80% of the rated voltage	
2.7	Minimum voltage under which motor will run satisfactorily	75% of the rated voltage for 5 minutes	
	Capacity to restart (at voltage specified in point No. 2.4)	i. TWO successive starts from cold condition ii. Two HOT restarts starts from Hot condition iii. Three equally spread start per hour	
2.8	High speed bus transfer withstand capability	Suitable to withstand 150 % of rated voltage	
2.9	Type of balancing for rotor	Dynamic balancing	
2.10	Direction of rotation	Suitable for both direction	
2.11	Direction of cooling air	Non-drive end to driving end	
2.12	Class of insulation	Class F with temperature rise limited to Class B.	
2.13	Winding treatment	The insulation shall be given tropical and fungicidal treatment for successful operation of the motor in hot , humid & tropical climate.	
2.14	Allowed winding temperature rise at continuous full load	60°C by thermometer method & 70°C by resistance method	

Cl No.	CHARACTERISTICS	REQUIREMENT	VENDOR COMPLIANCE (Refer Note: 2)
2.15	Starting current	**Less than or equal to 600% full load current subject to tolerance as per IS.(Normal motor)** **Less than or equal to 700% full load current subject to tolerance as per IS.(Energy efficient)**	
2.16	Starting time & locked rotor withstand time	The locked rotor withstand time (LRWT) at 110% rated voltage (RV) under **HOT** condition shall be at least 3 sec more than the starting time at 80% of rated voltage for motors with acceleration time upto 20 sec at RV and 5 sec where the accelerating time is more than 20 sec at RV.	
2.17	Vibration	The peak amplitude of vibration shall be as per IS 12075	
2.18	Noise level	Within the limits specified by IS 12065. (<80 db at full load condition) @ 1 metre distance.	
2.19	Type of enclosure	TEFC, IP 55 as per IS 4691.	
2.20	Type of mounting	Horizontal foot mounted.	
2.21	Bearings	Ball or roller type / bearings effectively sealed against ingress of dust. The bearing shall be so constructed that the loss of lubricating grease is kept to minimum. Sealed bearings are also acceptable.	
2.22	Lubricant Type	Grease	
2.23	Bearing life	Bearings shall have a minimum life of **40000** Working hours.	
2.24	Shaft extension	Motors shall be provided with key slotted bare shaft extension with key at the driving end.	
2.25	Terminal box Type	Weather proof IP 55 as per IS 4691, Capable of being turned through 360° in steps of 90°.	
2.26	Cable gland and lugs	Double compression type nickel plated brass cable glands and insulated tinned copper crimping lugs to suit the cable size shall be supplied along with the motor. i) Size of power cables will be intimated after PO. ii) For space heater cable glands and lugs suitable for 2CX2.5 to be provided	
2..27	Type of terminals	Stud / screw type with plain washers, spring washers / checknuts & lugs	

Cl No.	CHARACTERISTICS	REQUIREMENT	VENDOR COMPLIANCE (Refer Note: 2)
2.28	Fault level	40 KA for 0.25 Sec (Suitable HRC fuse backup will be provided by BHEL in MCC/switchgear)	
2.29	Painting	Epoxy based paint (Colour shade 631/ Shade 632/ Shade 275/ RAL 5012 as per IS:5. This will be confirmed after PO.	
30.0	Space heaters		
30.0.A	Motors above 30 kW	Separate space heater suitable for 240V, ! Phase, AC ,50 Hz shall be provided	
30.0.B	Motors below 30 kW	Winding shall be suitable for heating continuously at 24 V, Single phase, AC,50 Hz	
30.0.C	Terminals for space heater	Separately terminated with clear identification in main terminal box.	
31.0	RTD for winding	Two numbers of Thermistors / RTD for each phase as below are to be provided A. Motors above 37 Kw shall have thermistors Or RTD if specifically called for in enquiry. B. Motor rated 160kW and above shall have RTDs	
32.0	Bearing RTD	For motors 132 Kw and above bearing temperature detectors(RTD) shall also be offered.	
33.0	Terminals for RTD/ Thermistor	Thermistors/ RTDs shall be terminated in a auxiliary terminal box. Details shall be furnished in TB diagram.	
34.0	Earthing	Two no of earthing provisions on terminal box and on motor body	
35.0	Name plate	**As per IS 325 and Addl data on name plate::** a. Bearing DE/ NDE details. b. Year of manufacture	
36.0	Lifting Device	Eye bolt or lugs to facilitate safe lifting	
37.0	<u>INSPECTION & TESTING</u>	**As per applicable quality plan**	

Cl No.	CHARACTERISTICS	REQUIREMENT	VENDOR COMPLIANCE (Refer Note: 2)
	DOCUMENTS		
38.0	a) Along with offer:	One set of technical data sheet as per the enclosed format and Motor general arrangement drawing giving foundation details, shaft details.	
	b) After placement of Purchase order (**within 15 days**)	**Three sets of the following for approval:** 1. Technical Data sheet as per the enclosed format of TECI LTMOTOR REV 00- **sh 6 to 8** 2. Motor general arrangement drawing giving foundation details, shaft details and weight 3. Motor Terminal box arrangement drawing 4. Motor characteristic curves . The following shall be submitted 1.Guarantee certificate. 2. O & M manuals. 3. Acceleration time and LRWT calculation shall be submitted for review.	
39.0	PACKING	As per Packing Procedure **QA:CI:STD:PR:03** or as per Manufacturer's Standard Practice subject to approval . The packing shall meet the Transport , Environment & Storage hazards. **Vendor shall check the applicable rated voltage in enquiry.**	

NOTE:

1. Refer current valid list for revision status of Quality Plan & Packing Procedure.

2. In 'Vendor compliance' column Vendor to indicate 'YES', 'NO' or 'NOT APPLICABLE'. Clarification , if any, in this column will not be considered.

PO no ::

DATA SHEET - **Cust No ::** **Project ::**

CL. NO	CHARACTERISTICS	**Vendor data (To be filled by vendor)**
1.0	Application	
1.1	Fan / Load Curve referred	
2.0	Manufacturer	
3.0	Type & frame size	Normal / Energy efficient **Frame size**:
3.1	Degree of Protection	IP55
4.0	Rated output in kW	
4.1	Rated speed	
5.0	Rated voltage , frequency & phases	• **415 V** AC ±10%; 50 Hz ± 5%; (Check voltage as per engy), 10% absolute sum - 3 phase
6.0	Full load current	Amps
7.0	Energy efficient	**As per IS 12615**
8.0	Efficiency & power factor at Full load	Eff-- PF---
9.0	Efficiency & power factor at 75 % load	Eff-- PF---
10.0	Efficiency & power factor at 50 % load	Eff-- PF---
11.0	Duty Cycle	S1 - Continuous
12.0	Rated torque	
13.0	Starting current	600% of full load current
14.0	No load current (with mechanism coupled)	**@ RV and Frequency**
15.0	Starting torque in % of full load torque	
16.0	Pull up torque in % of full load torque	
17.0	Pull out torque in % of full load torque	
18.0	No load starting time (without mechanism coupled)	
19.0	Locked rotor withstand time at rated voltage	a. Hot b. Cold
20.0	Locked rotor withstand time at minimum starting voltage	a. Hot b. Cold
21.0	Locked rotor withstand time at 110% rated voltage	a. Hot b. Cold
22.0	Starting time at **minimum** starting voltage with mechanism coupled	
23.0	Starting time at **rated** voltage with mechanism coupled	
24.0	Maximum permissible starting time	
25.0	Stator thermal time constant	Minutes
26.0	Type & No of terminals brought out	

Cl no	CHARACTERISTICS	Vendor Data (**To be filled by vendor**)
27.0	Stator winding connection	Delta / star
28.0	Class of insulation & temperature rise	Class F; 60°C by thermometer method / 70°C by resistance method.
29.0	Minimum permissible starting voltage	Volts
30.0	Resistance per phase @20 Deg C (Indicative)	Ohms
31.0	No of successive starts in Hot condition	ONE / TWO
32.0	Quantity and power consumption of space heater	Qty== Watts==
33.0	Direction of rotation	Bi-Directional.
34.0	Bearing make & type	Make:: Drive End; Non Drive End;
35.0	Lubricant quantity , grade & recommended interval of lubrication	
36.0	Type of mounting & shaft orientation	Foot mounting; Horizontal.
	Terminal Box	
37.0	Location & angle of rotation	
38.0	Gland size for stator winding	
39.0	Gland size for space heater	Suitable for 2CX2.5 sq.mm(armoured), if applicable.
40.0	Cable entry	
41.0	GD^2 of motor ($kg\text{-}m^2$)	
42.0	Total weight of motor (kg).	
43.0	Weight of stator (kg)	
44.0	Weight of rotor (kg)	
45.0	Anticipated bearing life in Hours	
46.0	Method of connection to driven equipment	
47.0	Limiting rotor temperature for determining safe stall time	☐
48.0	RTD for winding/ Bearing	Applicable YES NO
49.0	Grade of balance of motor	
50.0	Standard continuous rating at 40 Deg C ambient.	
51.0	Derated rating of motor at 50 Deg C.	
52.0	a. Locked Rotor KVA b. Ratio of Locked rotor KVA / Rated KW	
53.0	a. Motor Dynamic Load b. Motor Static load	Upward/ Downward— Upward / Downward—
54.0	**PAINT SHADE**	

Vendor's signature and seal **Rev No ::** **Date ::**

The following curves are to be enclosed during datasheet approval.

1. GA drawing , Terminal box arrangement
2. Torque Vs Speed with load curve superimposed.
3. Speed Vs Current
4. Time Vs Current
5. Thermal with stand curve
6. Load Vs Efficiency
7. Load Vs Slip
8. Load Vs Power factor
9. Speed Vs Time
10. Load Vs Current.

The following information shall be specifically provided for motors suitable for VFD drive (if called for in eqny during datasheet approval in addition to datasheet.

1. **Stator RESISTANCE**
2. **Stator leakage reactance**
3. **Magnetising reactance**
4. **Rotor resistance referred to stator**
5. **Rotor reactance referred to stator**

Vendor's signature and seal.

Date ::

TECHNICAL SPECIFICATION DETAILS FOR INSTRUMENTATION FOR GATES & DAMPERS APPLICATION IN FLUE GAS DESULFURIZATION (FGD) for VINDYACHAL STAGE-V

SL.NO	INSTRUMENTATION
01.	SPECIFICATION OF TRANSMITTERS FOR PRESSURE, D.P, FLOW & LEVEL
02.	SPECIFICATIONS OF PR. GAUGE, D.P. GAUGE, TEMP. GAUGE AND LEVEL GAUGE.
03.	SPECIFICATION OF PROCESS ACTUATED SWITCHES
04.	SPECIFICATION OF SOLENOID VALVES
05.	SPECIFICATION OF RESISTANCE TEMPERATURE DETECTOR (RTD)
06.	SPECIFICATION OF TEMPERATURE TRANSMITTER
07.	SPECIFICATION OF FLOW ELEMENTS
08.	SPECIFICATION OF FLOW NOZZLE

Prepared,

Approved,

CLAUSE NO.	TECHNICAL REQUIREMENTS

1.00.00 All instruments shall be provided with durable epoxy coating for housings and all exposed surfaces of the instruments.

2.00.00 SPECIFICATION FOR ELECTRONIC TRANSMITTER FOR PRESSURE, D.P., FLOW AND LEVEL

Sl. No.	Features	Essential/Minimum Requirements
1.	Type of Transmitter	Microprocessor based 2 wire type, HART protocol compatible.
2.	Accuracy	± 0.1% of calibrated span (minimum)
3.	Output signal range	4-20 mA DC (Analog) alongwith superimposed digital signal (based on HART protocol)
4.	Turn down ratio	10:1 for vacuum/very low pressure applications.
		30:1 for other applications.
5.	Stability	± 0.1% of calibrated span for six months for Ranges up to and including70 Kg/cm².
		± 0.25% of calibrated span for six months for Ranges more than 70 Kg/cm²(g).
6.	Zero and span drift	+/- 0.015% per deg.C at max span.
		+/-0.11% per deg.C at min. span.
7.	Load impedance	500 ohm (min.)
8.	Housing	Weather proof as per IP-55 with durable corrosion resistant coating.
9.	Over Pr.	150% of max. Operating pr.
10.	Connection (Electrical)	Plug and socket type
11.	Process connection	1/2 inch NPT (F)

Sl. No.	Features	Essential/Minimum Requirements
12.	Span and Zero	Continuous, tamper proof, Remote as well as adjustability manual from instrument with zero suppression and elevation facility.
13.	Accessories	-Diaphragm seal, pulsation dampeners, syphon etc. as required by service and operating condition.
		-2 valve manifold for absolute pressure transmitters (3-valve manifold for gauge/ vacuum pressure transmitters) and 5 valve manifold for DP/level/flow transmitters.
		-For hazardous area, explosions proof enclosure as described in NEC article 500.
14.	Diagnostics	Self Indicating feature
15.	Power supply	24V DC ± 10%.
16.	Adjustment/calibration/maintenance	Centralised PC based system (In Employer's Scope). In addition total two (2) no. of hand- held type universal calibrators compatible with HART protocol, shall be provided.
Notes.	In case it becomes necessary to use a DP transmitter for pressure measurement then a 3-valve manifold should be used in place of 2-valve manifold.	
LVDT type is not acceptable.		
Where the process fluids are corrosive, viscous,solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diapragm shall be completely filled with an inert liquid suitable for the application.		

~~3.00.00~~ **ULTRASONIC TYPE LEVEL TRANSMITTERS** NOT APPLICABLE

ULTRASONIC TYPE LEVEL TRANSMITTER NOT APPLICABLE

ULTRASONIC TYPE LEVEL TRANSMITTER NOT APPLICABLE

4.00.00 **SPECIFICATION FOR PR. GAUGE, D.P. GAUGE, TEMP. GAUGE AND LEVEL GAUGE.**

Sl. No	FEATURES	ESSENTIAL/MINIMUM REQUIREMENTS		
		Pr. Gauge/ DP Gauge/ Draught gauges	**Temperature Gauge**	**Level Gauge**
1	Sensing Element and material	Bourdon for high pressure, Diaphragm/Bellow for low pr. Of 316 SS	Mercury in steel for below 450°C and inert gas actuated for above 450°C of SS bulb and capillary.	Tempered toughened Borosilicate gauge glass steel armoured reflex or transparent type.

Sl. No	FEATURES	ESSENTIAL/MINIMUM REQUIREMENTS		
		Pr. Gauge/ DP Gauge/ Draught gauges	**Temperature Gauge**	**Level Gauge**
2	Body material	Die-cast aluminium	Die-cast aluminium	Forged carbon steel/304 SS
3	Dial size	150mm	150 mm	Tubular covering entire range
4	End connection	1/2 inch NPT (F)	3/4" NPT (F)	Process connection as per ASME PTC and drain/vent 15 NB
5	Accuracy	±1% of span	± 1% of span	± 2%
6	Scale	Linear, 270° arc graduated in metric units	Linear, 270° arc graduated in °C	Linear vertical
7	Range selection	Cover 125% of max. of scale	Cover 125% of max. of scale	Cover 125% of max. of scale
8	Over range test	Test pr. for the assembly shall be1.5 to the max. Design pr. at 38°C.		
9	Housing	Weather and dust proof as per IP-55	Weather and dust proof as per IP-55	CS/304 SS leakproof
10	Zero/span adjustment	Provided	Provided	--
11	Identification	Engraved with service legend or laminated phenolic name plate		
12	Accessories	Blow out disc, siphon, snubber, pulsation dampener, chemical seal	SS Thermowell	Gasket for all KEL-F shield for transparent type vent and drain valves of Steel/SS as per CS/Alloy process

Sl. No	FEATURES	ESSENTIAL/MINIMUM REQUIREMENTS		
		Pr. Gauge/ DP Gauge/ Draught gauges	**Temperature Gauge**	**Level Gauge**
		(if required by process) gauge isolation valve		Requirement.
13	Material of Bourdon/ movement	316 SS / 304 SS	316 SS / 304 SS	

Notes:-

Length of gauge glass shall not be more than 1400 mm. If the vessel is higher, multiple gauge glasses with 50 mm overlapping shall be provided.

Where the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application.

5.00.00 PROCESS ACTUATED SWITCHES

FEATURES	ESSENTIAL / MINIMUM REQUIREMENTS		
	Pressure/ Draft Switches/ DP Switches	**Temperature switches**	**Level switches**
Sensing Element	Piston actuated for high pressure and diaphragm or bellows for low pr./ vacuum	Vapor pressure sensing, liquid filled bellow type with SS bulb and capillary (10 m minimum) above gland	Float type switches/RF type for applications as decided by Employer during detailed engineering.
			Radio-frequency/capacitance type for other application.

FEATURES	ESSENTIAL / MINIMUM REQUIREMENTS		
	Pressure/ Draft Switches/ DP Switches	**Temperature switches**	**Level switches**
Material	316 SS	Bulb 316 SS/ capillary 304 SS	316 SS
End connection	½ inch NPT (F)	½ inch NPT (F)	Manufacturer standard
Over range proof pressure	150% of max. design pr.	-	150% of max. design pressure
Repeat-ability	± 0.5% of full range		
No. of contacts	2 No.+2NC. SPDT snap action dry contact		
Rating of contacts	60 V DC, 6 VA (or more if required by or PLC)*		
Elect. Connection	Plug in socket		
Set point/ dead band adjustment	Provided over full range		
Enclosure	Weather and dust proof as per IP-55		
Accessories	Syphon, snubber, chemical seal, pulsation dampeners as required by process	Thermo well of 316 SS and packing glands	All mounting accessories

FEATURES	ESSENTIAL / MINIMUM REQUIREMENTS		
	Pressure/ Draft Switches/ DP Switches	**Temperature switches**	**Level switches**
Mounting	Suitable for enclosure/ rack mounting or direct mounting	Suitable for rack mounting or direct mounting	-
Where the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application.			

5.01.00 Limit switches shall be silver plated with high conductivity and non-corrosive type. Contact rating shall be sufficient to meet the requirement of Fire alarm Control System subject to a minimum of 60V, 6VA rating. Protection class shall be IP-55.

6.00.00 **SOLENOID VALVES**

Solenoid valves shall fulfill the following requirements : -

a) Type 2/3/4 way SS 316/ forged brass (depending on the application subject to Employer's approval during detailed engg.)

b) Power supply 24V DC.

c) Plug in connector connection.

d) Insulation : Class "H"

7.00.00 **TEMPERATURE ELEMENTS** NOT APPLICABLE

7.01.00 THERMOCOUPLE NOT APPLICABLE

THERMOCOUPLE NOT APPLICABLE

7.02.00 **Resistance Temperature Detector (RTD)**

Sr. No.	Features		Essential/Minimum Requirements
1	Type of RTD.	:	Four wire, Pt-100 (100 Ohms resistance at zero degree Centigrade).
2	No. of element	:	Duplex
3	Housing/Head	:	IP-55/Diecast Aluminium. Plug in connectors are to be provided for external signal cable connection.
4	Sheathing of RTD	:	Metal sheathed, ceramic packed
5	Calibration and accuracy	:	As per DIN-43760 Class-A for RTD
6	Characteristic	:	Linear with respect to temp, within ±1/2 percent of top range value.
7	Accessories	:	Thermo well (as specified below) and shall be spring loaded for positive contacts with the well.
8	Standard	:	DIN-43760 for RTD and ASME PTC-19.3 for Thermo-well.

CLAUSE NO.	TECHNICAL REQUIREMENTS
7.03.00	**Thermo well (for all process temp. elements)** (a) Shall be one piece solid bored type of 315 SS of step-less tapered design. (As per ASME PTC 19.3 1974) (b) For Mill classifier outlet long life solid sintered tungsten carbide material of high abrasion resistance shall be provided. (c) For Air & Flue gas 316 SS protecting tube with welded cap. (However contractor shall provide better material for Flue gas service if require based on the specify boiler design parameters). (d) For furnace zone, impervious ceramic protecting tube of suitable material along with Incoloy supporting tubes and adjustable flanges.
8.00.00	**TEMPERATURE TRANSMITTER** Following types of 2-wire temperature transmitter (directly powered from 4-20mA input cards of PLC) shall be provided. The temperature transmitter shall be fully compatible with thermocouples and RTDs being provided by the contractor. Temperature compensation of the thermocouples shall be performed in the temperature transmitter itself. a. Single Input Head mounted Temperature Transmitter These shall be suitable for mounting in the head of temperature element itself. The protection class of head of thermo well along with its plug-in connector shall be min. IP65. b. Single Input DIN-rail mounted Temperature Transmitter These shall be especially designed for DIN-rail mounting in JBs. The specifications of the JBs shall be same as indicated in Subsection-IV:I7 (INST CABLE) with additional DIN-rails and IP 65 Protection class. This temperature transmitter shall be the ones which are specially designed for DIN-rail mounting with IP 20 protection class. These shall have terminals for input/output provided on front side when mounted on DIN-rail. Head mounted temperature transmitter with clamps to make it suitable for DIN-rail mounting shall not be acceptable under this category. c. Dual-input Temperature Transmitter With Indicator: The dual-input TTs shall be suitable for mounting in enclosures/racks and shall be provided with clamps. Indicator shall be provided with these transmitters. These transmitters shall have bump less change over facility to

second sensor in case first sensor fails .This change-over is to be alarmed. Protection class shall be IP65 minimum.

d. Common requirements for each of the above type of temperature transmitters

Output	:	2-wire (power supply from input card of Control System) with 4-20mA output with superimposed HART protocol signal.
Input	:	Same transmitter shall be capable to handle Pt-100 RTD , Thermocouples -K&R types (input type to be selectable at site through HART terminal)
Isolation	:	min. 500 V AC
EMC compatibility	:	as per EN 61326
Operating ambient temperature	:	0 to 85 deg C (without indicator) 0 to 70 deg C (with indicator)
Power supply		compatible with input module of Control System
Accessories		Mounting arrangements including clamps etc.
Composite Accuracy (Refer note 2)		(a) For head mounted and DIN-rail mounted types: RTD =<0.4% of 0-250 deg C span T/C-K type =<0.4% of 0-600 deg C span T/C-R type =<0.4% of 0-1000 deg C span CJC accuracy (for thermocouples) shall be =< 1 deg C (b) For dual-input type: RTD =<0.25% of 0-250 deg C span T/C-K type =<0.2% of 0-600 deg C span CJC accuracy (for thermocouples) shall be =< 1 deg C

CLAUSE NO.	TECHNICAL REQUIREMENTS
9.00.00	**SPECIFICATION FOR FLOW ELEMENTS**
9.01.00	**Orifice Plate**

Features	**Essential/Minimum Requirements**
Type	Concentric as per ASME PTC-19.5 (Part-II), ISA RP-3.2, 1960 or BS-1042
Material	316 SS
Thickness	3 mm for main pipe diameter up to 300 mm and6 mm for main pipe dia above300 mm.
Material of branch pipe	Same as main pipe
Root valve type	Globe
Root valve material	316 SS
Root valve size	1 inch
Impulse pipe of same material up to root valve	Required
Tappings	Flanged weld neck. 3 pairs. of tapping.
Beta Ratio	0.34 to 0.7
Beta Ratio calculation to be submitted	Yes
Assembly drg. and flow Vs DP Curves	Yes
Accessories	Root valves, flanges, Vent/drain hole (As required)

Contractor shall submit certified flow calculation and differential pressure vs. flow curves for each element for Employer's approval. Sizing calculation, precise flow calculation for all the flow elements, fabrication and assembly drawings and installation drawings shall be submitted for Employer's approval. One Flow element of each type shall be calibrated in the test laboratory for validation of computated flow calculations.

CLAUSE NO.	TECHNICAL REQUIREMENTS
9.02.00	**Flow Nozzle**

Features	**Essential/Minimum Requirements**
Type	Long radius, welded type as per ASME PTC-19.5 (Part-III) or BS-1042
Material	316 SS
Thickness	Suitable for intended application.
Material of branch pipe	Same as main pipe
Root valve type	Globe
Root valve material	316 SS
Root valve size	1 inch
Impulse pipe of same material up to root valve	Required
Tapping	D and D/2 (3 Nos. of tappings)
Beta Ratio	Around 0.7
Beta Ratio calculation to be submitted	Yes
Assembly drg. and flow Vs DP Curves	Yes
Accessories	Root valves, vent and drain hole.

Contractor shall submit certified flow calculation and differential pressure vs. flow curves for each element for Employer's approval. Sizing calculation, precise flow calculation for all the flow elements, fabrication and assembly drawings and installation drawings shall be submitted for Employer's approval. One Flow element of each type shall be calibrated in the test laboratory for validation of computed flow calculations.

PERFORMANCE TEST PROCEDURE OF GATE / Bi-Plane DAMPER

(On FLOW)

PROJECT : NTPC VINDHYACHAL , Unit-13 (R549)

Rev.	Date	Description	Sign

EDC-DP,GATES & DAMPERS

BHARAT HEAVY ELECTRICALS LIMITED

Boiler Auxiliaries Plant

RANIPET – 632 406

Date	Prepared	Reviewed	Approved
13-10-2014	Masabattula Suresh	V. Kesavan	D. Ashwin Dhinakar

1. Scope

This procedure deals with the Test set up, methodology and calculations involved in type testing of Gate / Damper for establishing the leak tightness of Gate / Damper used in pressurized systems.

2. Reference documents

2.1 Corresponding Drawings
2.2 Approved Quality Plan

3. General

3.1 The Gate & Flap damper shall be tested in vertical position and the damper shall be tested in horizontal position Approved Quality Plan.

3.2 The Gate / Damper shall be operated for a minimum of five (5) times, before testing.

3.3 One operation is defined as from fully closed position to fully open position and back to fully closed position.

3.4 Upon completion of testing, the Gate / Damper shall be visually inspected for any physical damage to its components.

4. Test Procedure

4.1 Equipment requirement for type test is detailed out and the arrangement of the test equipment shall be as shown in the Annexure – II & III when they are to be tested without using seal air and as per Annexure – IV & V when they are to be tested with seal air.

4.2 The Gate / Damper (Item No. 01) shall be kept closed.

4.3 Energize the pressurizing fan (Item No. 02) and by adjusting the by-pass valve (Item No. 06) set the plenum duct (Item No. 04) pressure to the Gate / Damper pressure at MCR condition by using pressure tap (Item No. 07) and U Tube Manometer / Digital manometer.

4.4 Measure and record the velocity head at Pitot tubes (Item No. 08). Minimum three readings will be taken in each measurement and average will be recorded. Readings will be tabulated as per Annexure –I.

4.5 Using the formulae given in clause 5.0, calculate the leakage flow rate and estimate the degree of leak tightness of Gate / Damper.

4.6 If Seal Air is applicable, the same shall be connected and leakage will measured and calculated with Seal Air as per the step 4.3 to 4.5. Refer test set up drawings, Annexure – IV & V)

5 Calculations

Variables

Q_S	-	Volumetric flow rate of medium at MCR	m^3 /sec
D	-	ID of connecting pipe	mm
T	-	Temperature	deg C
Pst	-	Plenum Chamber Pressure (static)	mm WC
Vp	-	Velocity head	mm WC
d	-	Density of air	kg/m^3
A	-	Connecting duct area of Cross section	m^2
V	-	Velocity	m/sec
Q	-	Flow rate (leak rate)	m^3/ sec

$$V = \frac{4.4222 \times K \times \sqrt{Vp}}{\sqrt{d}}$$

Where V - Velocity of air in m /sec
Vp - Velocity head in mm of WC measured in pitot tube
K - Constant for single point reading (0.91 for single point reading)
d - Air density (kg/m^3) at test temperature and pressure.

$$d = \frac{1.225 \times (288.5)}{(273 + T^{o}C)} \times \frac{(10335 + Pst)}{10335}$$

$$Q = A \times V$$

$$\% \text{ Leakage} = \frac{\text{Leakage flow (Q)}}{\text{Flow rate of medium at MCR}} \times 100$$

Correction for Temperature & Pressure:

$$Q1 = Q \times (d / d1)$$

Where,
Q1 - Leak rate of medium at specified temperature & pressure
d1 - Density of medium at specified temperature & pressure

Percentage Leak at site condition, $L_S = (Q1/Q_S) \times 100$
Therefore Leak Tightness at site, $LT_S = (100 – L_S)\% = (1 - Q1/Q_S) \times 100\%$

Equipment List

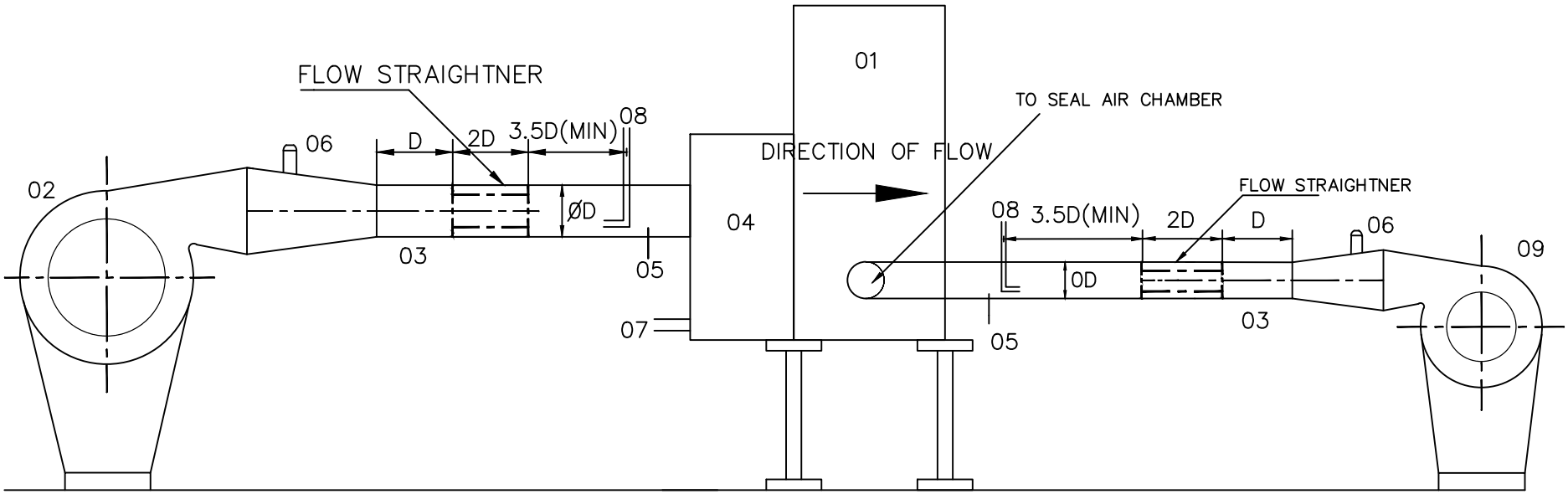
Item No.	Description
01	Typical Gate / Damper : Gate / Damper to be tested
02	Pressurizing Fan sized to provide air supply at rated pressure to the plenum duct (Item No. 04) for testing.
03	Connecting pipe to connect pressurizing fan and plenum duct.
04	Plenum Duct to apply pressure to the Gate / Damper
05	Thermometer to measure the Temperature.
06	Bypass Valve mounted on the connecting duct to regulate the pressure in the plenum duct.
07	Pressure Tap provided to measure the air pressure in the plenum duct.
08	Pitot tube to measure velocity head.
09	Seal Air Blower (In case of testing using seal air supply. Refer Annexure- IV & V)

Annexure – I

LEAKAGE TEST OF GATE / BIPLANE DAMPER / FLAP DAMPER						
Project :			**Size :**			
WO No :			**Test Date :**			
			Time :			
Measured Values	**Unit**	**Test 1**	**Test 2**	**Test 3**	**Test 4**	**Test 5**
Pressure (Atm),PB	mbar					
Wet bulb temp, tw	°C					
Dry bulb temp, td	°C					
Track temp, T	°C					
Plenum chamber st. pr, Pst	mmWC					
Track static pr, Pst-track	mmWC					
Track dynamic pr, Vp	mmWC					
Area of track, A	m^2					
Seal air Pr	mmWC					
Calculated Values						
Volume flow thro' gate (MCR) Qs	m^3/s					
Density (site), d1	kg/m^3					
Air density (test), d	kg/m^3					
Air velocity, V	m/s					
Volume leak (test), Q	m^3/s					
% of leak tightness (test)	%					
Volume leak (site),Q1	m^3/s					
% of leak tightness (site)	%					
Tested by :			**Witnessed by :**			

ALL DIMENSION ARE IN MM

DRAWING NOT TO SCALE



TIEM NO	ITEM NAME
01	GATE
02	PRESSURISING FAN
03	CONNECTING TRACK
04	PLENUM CHAMBER
05	THERMOMETER
06	BY PASS VALVE
07	PRESSURE TAP
08	PITOT TUBE
09	SEAL AIR BLOWER

Bharat Heavy Electricals Ltd
UNIT: BOLIER AUXILIARIES PLANT
RANIPET – 632 406
355–052

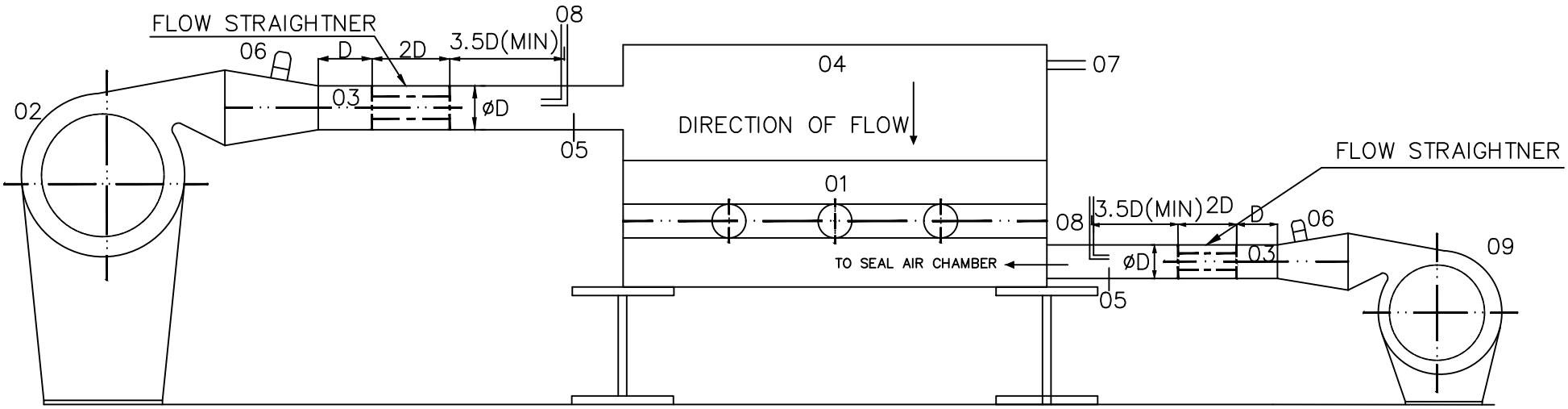
TITLE

TEST SETUP FOR GUILLOTINE GATE WITH SEAL AIR BLOWER

DRAWN	APPROVED.	DATE	DRAWING NO :	REV
A. NATARAJ	M. THAGAVEL	06.03.12	ANNEXURE–IV	00

ALL DIMENSIONS ARE IN MM

DRAWING NOT TO SCALE



TIEM NO.	DESCRIPTION
01	DAMPER
02	PRESSURISING FAN
03	CONNECTING TRACK
04	PLENUM CHAMBER
05	THERMOMETER
06	BY PASS VALVE
07	PRESSURE TAP
08	PITOT TUBE
09	SEAL AIR BLOWER

Bharat Heavy Electricals Ltd UNIT: BOLIER AUXILIARIES PLANT RANIPET – 632 406 355-052		TITLE: TEST SETUP FOR BI-PLANE DAMPER WITH SEAL AIR BLOWER		
DRAWN	APPD	DATE:	DRAWING NO :	REV
A. NATARAJ	M. THAGAVEL	06.03.12	ANNEXTURE-V	00

DATA SHEET FOR FGD OUTLET GATE DS-57570

Project: VINDHYACHAL – 1 x 500MW (R549) **Qty/Boiler: 1 No**

SL.No	Description		Outlet gate Requirement	Vendor Comments / Acceptance / Deviations
01	Duct inside dimension in mm (horizontal width(W) x vertical height(H))		6000(W) x 12007(H)	
02	Flow direction		Horizontal	
03	Finished gate width x height (Overall)		Vendor to mention	
04	Outer casing thickness		9 mm or above. Vendor to mention	
05	Frame depth flange to flange (mm)		~ 400 mm. Vendor to specify	
06	Design & Operating pressure - mm of water column		Design ±660 & Operating 40 (approx)	
07	Design Temperature		200°C	
08	Operating Temperature		FGD in service (Gate Open) Upstream : 105°C Downstream : 105°C	
			FGD Bypassed (Gate Closed) Upstream : Ambient Downstream : 145°C	
09	Velocity in m/sec		13	
10	Blade material	Upstream side	SS317LMN or better/C276 cladding of 1.6 mm thickness	
		Downstream side	Vendor to specify	
11	Frame material	In contact with flue gas	S-Ten1 /A36 lined with 5 mm thick SS317LMN or better / 1.6 mm thick C276 cladding	
		Not in contact with flue gas	Vendor to specify	
12	All seal material		ASTM B575 UNS N10276	
13	Construction		split / modular vendor to specify	
14	Shaft material (To be suitable for FGD service)		vendor to specify	
15	Shaft Seal material		vendor to specify	
16	Power transmission mechanism (should be suitable for Modular design & comply Open / Close timing)		Rack and pinion / lead screw/ Chain & sprocket	
17	Gate Sealing efficiency without / with seal air (Volumetric flow method)		99.8% / 100%	

18	Seal air system	1 x 100% (No standby blower)	
19	Seal air supply - open /close position of blade or continuously required	Vendor to specify	
20	Blower mounting arrangement	Vendor to provide	
21	Seal air volumetric flow (CFM) & pressure (mm WC) at i) Blower & ii) Gate frame inlet	Vendor to specify	
22	Blower motor rating in KW Blower Make & Model no.	Vendor to specify	
23	Actuator Gear box- Make & model no.	Vendor to specify	
24	Gate Actuator Make, Model No. & motor rating KW (With Integral starter)	Vendor to specify	
25	Heater and related instrumentation for seal air – Make, Model no. & Rating KW	Vendor to specify	
26	Time taken for raising / lowering gate blade (shall be ≤ 8 minutes)	Vendor to specify	
27	Actuator torque rating Stall Run No Load Starting Torque Sizing torque	Vendor to specify	
28	Auxiliary Power consumption in KW i) Blower in Gate Blade Open condition ii) Blower in Gate Blade Closed condition iii) Heater in Gate Blade Closed condition	Vendor to specify	
29	Weight of Assembled Gate with all Accessories in kg	Vendor to specify	

Note:

1) Vendor shall also fill up the enclosed “Electrical Actuator Data sheet” (TDA: NTPC: DAE: OCIS / Rev.03) pages 11 to 14 of 14 and submit along with Offer..

VENDOR SIGNATURE :

SEAL:

SPECIFICATION

FOR

ELECTRIC DAMPER ACTUATORS

(OPEN/CLOSE TYPE)

WITH INTEGRAL STARTERS

REV. NO.	DATE	DESCRIPTION	PREPARED	REVIEWED	APPROVED
00	27.12.2007	**INITIAL RELEASE** Prepared inline with Spec.No. TDA:STD:DAE:OCIS:REV00	P. Muthukumar	S.Rangarajan	S.Rangarajan
01	23.08.2008	Cl.No.A.7.1 (No. of Remote Position Transmitter) is corrected.	-sd-	-sd-	-sd-
02	09.11.2009	Cl.No.P.1(Paint and finish) is corrected.	-sd-	-sd-	-sd-
03	27.05.2014	Cl.No.G.3.5 to G.3.17, G.4.3 to G.4.7 & M.2.6 are added.	K.Priyadharshini	S.Rangarajan	S.Rangarajan

ENGINEERING DEVELOPMENT CENTRE

BHARAT HEAVY ELECTRICALS LIMITED

RANIPET

The vendor shall furnish clearly along with quotation details for each of the items listed out in the specification without ambiguity.

GENERAL

G.1 **ENCLOSURE**

G.1.1 Actuators shall be of a totally enclosed, weatherproof and dust proof construction with minimum IP 55 enclosure and shall be suitable for outdoor applications.

G.1.2 Actuator shall be suitable for operation in damp, dusty polluted atmospheres of 95% relative humidity and ambient temperatures varying from -20° C TO +50° C.

G.2 **VOLTAGE**

G.2.1 The unit shall be suitable for operation on a 415V 3 phase 50 c/s. A.C. supply.

G.3 **CONSTRUCTION**

G.3.1 Damper actuators are open/close duty, direct shaft mounting type.

G.3.2 The exact mounting arrangement with dimensions shall be clearly furnished along with the offer.

G.3.3 Each actuator shall have a hand wheel fitted on it for emergency operation. The hand wheel shall be designed such that it is declutched automatically when the power supply to the motor is restored. The hand wheel engaging lever shall give trouble-free performance under repeated operations.

G.3.4 Actuators offered shall be with self-locking worm.

G.3.5 Actuators should consist of basic actuator and secondary gear box and should be supplied in Toto (properly coupled).

G.3.6 For connecting actuator secondary gear box damper necessary fasteners should be supplied along with actuators.

G.3.7 Double compression type cable glands (brass nickel plated) 3 Nos. for control cables and one No. for power cable shall be provided in the actuators. The exact cable size will be informed during drawing approval.

G.3.8 Actuator shall be clockwise to close.

G.3.9 All RH mounted actuators shall be clockwise to close. Clockwise rotation of manual hand wheel shall always result closing of actuators.

G.3.10 Key way length shall be for total length of bore.

G.3.11 The Bore and key way tolerance are given below.

Description	Main Dimension	Tolerance allowed
Bore Diameter	All	+0.05mm to -0.00 mm
Key way width	<=16 mm	-0.06 to -0.02 mm
Key way width	>16 mm	-0.07 to -0.02 mm
Key way depth	<= 3.8 mm	0.1 mm to -0.00
Key way depth	>3.8 mm	0.2 mm to -0.00

G.3.12 All actuators shall have removable output bush.

G.3.13 No part of actuator shall protrude beyond secondary gear box flange.

G.3.14 Separate name plate shall be provided in the actuator.

G.3.15 All the basic actuators and the gear boxes should have undergone endurance testing. Reference standards are EN15714 for basic actuator and AWWA standard for Gear box.

G.3.16 Supplier shall confirm self locking is provided in their design. Further to self Locking, the supplier shall confirm over travel will not be there in their design i.e., when power is switched off, gear box should not rotate and gate should not come down on its own. Supplier shall give specific confirmation to this point.

G.3.17 Sizing calculation to be furnished along with the offer for new models which are not supplied to BAP Ranipet earlier.

G.4 **TORQUE**

G.4.1 The actuators shall be capable of giving the required torque at the output Shaft. (Required torques are given in the data sheet).

G.4.2 Indicate the adjustable range of run torque and starting torque of actuator in Kgm for each actuator offered. The actuator shall be designed to operate at the running torque for a period of 15 min or 3 successive open-close operations whichever is longer.

G.4.3 Starting torque of the actuator (Basic actuator + Secondary Gearbox) shall be greater than the damper starting torque.

G.4.4 The actuator (Basic actuator+sec.GB) Run Torque (6 min or 15 min) shall be

greater than the Damper Run torque (6 min or 15 min).

G.4.5 The stall torque of the actuator (Basic actuator + sec. Gear box) shall be lesser than the damper stall torque.

G.4.6 The momentary torque capacity, continuous torque capacity and maximum torque capacity of the secondary Gear box shall be greater than the starting torque of the actuator (Basic actuator + sec. Gear box).

G.4.7 The run torque range of the actuator (Basic actuator + sec. Gear box) shall cover the required run torque mentioned in the data sheet.

G.5 **REVOLUTIONS**

G.5.1 Each actuator shall be capable of giving total operating turns as indicated in the data sheet. Please furnish actual number of turns available for each actuator offered.

G.6 **SPEED**

G.6.1 Desired output speeds are indicated in the data sheet. Actual speeds of actuators offered shall be clearly indicated.

G.7 **WEIGHT**

G.7.1 Furnish weight of actuators including all accessories.

G.8 **LUBRICANT**

G.8.1 The gearbox of the actuator shall preferably be oil filled. The actuator shall have proper seals to prevent leakage of oil into the limit switch compartments, terminal box and motor. Actuator shall be designed for mounting in any position without lubricant leakage or other operational difficulty.

G.9 **DIMENSIONAL CATALOGUES**

G.9.1 Three copies of catalogues of the actuators in English language describing the constructional details shall be sent along with the offer. The catalogues shall also provide over all dimensions of the actuators and other details called for in the specification.

G.10 **O & M INSTRUCTION MANUALS**

G.10.1 25 copies of operating and maintenance instruction manual shall accompany each actuator ordered.

ACCESSORIES

A.1 **TORQUE SWITCHES**

A.1.1 Two numbers adjustable torque switches (one for open and one for close), each with 2 NO and 2 NC potential free contacts.

A.1.2 It is required to have calibration in Kg-m (for whole actuator including secondary gear box) for the torque switches so that the switches could be easily set to any value desired, within the range specified for each actuator.

A.1.3 Gear train shall be made of metal (Fiber gears are not acceptable).

A.2 **LIMIT SWITCHES**

A.2.1 Two numbers of position limit switches, rotary drum type capable of being set at any position (one for open and one for close) each with 2 NO & 2 NC potential free contacts.

A.2.2 Two auxiliary limit switches rotary drum type capable of being set at any position (one for open and one for close) each with 2 NO and 2 NC potential free contacts.

A.2.3 Gear train shall be made of metal (Fiber gears are not acceptable).

A.3 **MICRO SWITCHES**

A.3.1 Limit switches & torque switches shall be enclosed in weatherproof compartment suitably for damp atmospheres and shall not cause any trouble during commissioning and operation.

A.3.2 Limit switch compartment shall be weatherproof and spacious enough for easy setting.

A.3.3 The switches shall be suitable for 5A at 240V AC; 0.5A (Inductive) at 220V DC.

A.4 **LOCAL POSITION INDICATORS**

A.4.1 Each actuator shall have a local position indicator to indicate 0 to 100% of travel.

A.5 **ELECTROMAGNETIC BRAKES**

A.5.1 In case electromagnetic brakes are provided in the actuators the same shall have IP 55 weatherproof enclosures.

A.6 **SPACE HEATER**

A.6.1 Each actuator shall have a space heater of adequate rating in the limit switch compartment suitable for 240V AC, 50 C/S single phase supply.

A.7 **REMOTE POSITION TRANSMITTER**

A.7.1 Each open/close actuator shall have one number of remote position transmitter of LVDT type for remote indication.

MOTORS

M.1 **POWER SUPPLY**

M.1.1 Motor shall be suitable for operation on a 415V, 3 phase 3 wire ungrounded supply system.

M.1.2 Motor shall operate without any trouble under the following conditions.

a. If the voltage varies within ± 10% of the rated value of 415 V.

b. If the frequency of the power source varies within ± 5% of 50 C/S.

c. If the voltage and frequency of the source vary simultaneously and the sum of the absolute percentage values in variation does not exceed 10%.

M.2 **CONSTRUCTIONS**

M.2.1 Motor shall be squirrel cage induction type. The enclosure shall be totally enclosed, self ventilated with minimum IP 55 degree of protection.

M.2.2 Motor shall be conforming to BS 2613-70, IS 325 or any other equivalent international standard for all requirements unless otherwise specified herein.

M.2.3 Motor shall be painted with corrosion proof epoxy-resin paint.

M.2.4 Motor shall be provided with inbuilt thermostat connected in series (one thermostat in each phase) & wired to limit switch compartment.

M.2.5 Motors shall have double shielded, grease lubricated anti-friction bearings.

M.2.6 Drive motor shall be provided with in-built thermistor for over load protection.

M.3 **INSULATION**

M.3.1 Motor shall have class B insulation with troplicalisation suitable for polluted dusty and corrosion atmosphere of relative humidity 90%.If higher insulation is provided, the temperature rise shall be limited to class-B insulation. Motor shall be designed for ambient temperatures varying between -20°C or +50°C.

M.4 **RATING**

M.4.1 For open/close actuator motor shall be short time rated for S2-15 minutes duty or 3 successive open-close operations whichever is longer.

M.5 **STARTING**

M.5.1 Motor shall be suitable for direct on-line starting.

M.5.2 Starting current shall be limited to 6 times the rated current.

M.5.3 Motor shall be capable of

1. Starting at 85% of rated voltage.
2. Running at 80% of rated voltage for a period of 5 minutes.

M.6 **EARTHING TERMINALS**

M.6.1 2 Nos. Earthing terminals shall be provided on the body of the motor.

M.7 **MOTOR DATA**

M.7.1 Motor data sheets for each type of actuators ordered shall be furnished. Internal wiring and limit switch contact development diagram for the actuators ordered shall be furnished.

M.8 **WEIGHT**

M.8.1 Weight of the motor shall be furnished with the offer.

M.9 **TESTS**

M.9.1 Tests are to be conducted as per relevant Indian Standards and international standards as given below. Required copies of the test certificates are to be furnished for the tests.

CONTROLS

C.1 **INTERNAL WIRING**

C.1.1 Internal wiring of the actuators shall be as per our diagram enclosed with enquiry. The terminal marking also shall be according to the enclosed wiring diagram & limit switch contact development shall be as per BHEL drawing.

C.1.2 Internal wiring diagram shall be neatly pasted on the cover of terminal box .

C.2 **TERMINAL BOX**

C.2.1 All terminals of position limit switches, torque limit switches, space heaters and positions transmitters shall be brought to a common terminal board. The terminals shall be of screw-type with sufficient insulation between 2 adjacent terminals.

C.2.2. Minimum 5 number of terminals shall be available in the terminal board as spare terminals.

C.2.3 Terminal box of actuator shall be weatherproof and have enough space for connecting cable glands/ plug and sockets as indicated in BHEL drawing. Insulation voltage for power terminal block & control terminal block is 650V

grade.

C.2.4 Terminal box of motor shall be weather-proof and have enough space for connecting 1 number Power cable which will be indicated before placement of order. Motor terminals shall be stud-type.

C.2.5 The terminal boxes shall be fitted with a removal front cover-plate.

C.2.6 Internal wiring shall be done with 650V, 1.5 sq.mm PVC insulated stranded copper wires. Ferrules should be provided on the wires for easy identification.

S.1 **SPARES**
Vendor shall specify a list of recommended spares for 2/5 years of trouble free operation.

P.1 **PAINT & FINISH**

All external parts shall be finished and painted/powder coated to produce a neat and durable surface, which would prevent Rusting & Corrosion. The equipment shall be thoroughly degreased and sharp edges and scales removed and treated with one coat of Epoxy Primer and two coats of Epoxy enamel paint. Refer enquiry for paint shade. The consolidated thickness (one coat of Epoxy primer and two coats of Epoxy enamel) of the paint coats shall be minimum of 100microns.

P.1:2 All fasteners used in the construction of the equipment shall be either of corrosion resistant material or high cadmium plated. Current carrying fasteners shall be either of Stainless Steel or High Tensile Brass or Copper.

PURCHASE SPECIFICATION FOR ELECTRONIC INTEGRAL STARTER

1.0 GENERAL

Vendors shall furnish point wise confirmation / deviation to each clause of this specification explicitly.

2.0 INTEGRAL STARTER FEATURES

2.1 The integral starter shall be provided in a weather proof enclosure with protection class IP67/IP68.

2.2 The control logic of integral starter shall be through Electronic logic control. Hardwire control logic is not acceptable. The electronics should be capable of operating in a temperature range of -20 deg.C to +50 deg.C. Entire integral starter unit along with basic actuator shall conform to IP67/68 Encl standards.

2.3 Control supply voltage of the starter shall be 24V DC or 110V AC. If 110V AC is used, then the same shall be derived with step down transformer of 415/110V. Necessary primary and secondary fuses shall be provided Opto isolation circuit shall

be provided with suitable coupling relays for 24V DC commands from external control system.

2.4 INTEGRAL STARTER COMPONENTS:

2.4.1 Electrically and mechanically interlocked contactors shall be provided for forward and reverse operation. Contactor rating shall be sufficient to withstand the extreme conditions like valve jamming and instantaneous reversal of motor.

2.4.2 Key lockable Selector switch for LOCAL-OFF-REMOTE selection shall be provided.

2.4.3 OPEN-STOP-CLOSE push buttons (for local operation) shall be provided.

2.4.4 Thermal overload relay shall be provided in addition to thermostats embedded in motor winding. Overload relay and thermostats shall be connected in control circuit to trip actuator in case of overload. OLR set value shall be mentioned in wiring diagram

2.4.5 Automatic phase correction facility and single phasing prevention shall be available.

2.4.6 Interposing relays provided (with coil burden <=2.5VA, one for open and one for close) to initiate opening and closing by 24V DC signal from the external control system.

2.4.7 Open/Close command termination logic with position and torque limit switches shall be suitably built in the PCB inside the actuator.

2.4.8 Necessary fuses shall be provided.

2.4.9 For torque closing valves, open torque switch shall be bypassed initially for 3 secs or 5% of the valve travel.

2.4.10 Space heater for switch compartment shall be provided with internally derived power supply.

2.4.11 It should also be possible to reverse the direction of travel for inching valves (in LOCAL and REMOTE) without giving stop command.

2.4.12 Provision shall exist in electronic control for bypassing the torque switch during initial 5% opening of dampers. Details for this must be indicated in the wiring diagram.

3.0 INPUT COMMANDS:

3.1 Open command (24V DC)

3.2 Close command (24V DC)

4.0 OUTPUT CONTACTS FOR CUSTOMER USE :

4.1 A common potential free contact (monitoring relay) shall be available to annunciate the following faults.

a. Thermostat trip
b. OLR trip

c. Actuator jammed in mid-travel.
d. Motor single phasing.
e. Control supply failure.
f. Local stop
g. L/R selector switch not in remote.
h. Torque switch trip (In case tripping by close torque switch is chosen, the same should not be considered as a fault signal).

4.2 Local stop PB operated.

4.3 Actuator opened.

4.4 Actuator closed.

4.5 Open torque switch acted.

4.6 Close torque switch acted

4.7 L/R switch local.

4.8 L/R switch OFF.

4.9 L/R switch remote.

5.0 The following status annunciation shall be made available locally in the actuator.

a. Actuator OPEN
b. Actuator CLOSE
c. Actuator running
d. Internal 24V DC control voltage healthy.

Note: Alternatively a diagnostic tool shall also be provided at free of cost.

6.0 The following individual fault annunciation shall be made available locally in the actuator for easy trouble shooting.

a. Torque switch OPEN
b. Torque switch CLOSE
c. Thermostat trip
d. Thermal overload relay trip
e. Motor single phasing

Note: Alternatively a diagnostic tool shall also be provided at free of cost.

7.0 The actuator shall be suitable for the following signals interfacing with remote control system.

a. Open command from remote control system (Potential free contact).
b. Close command from remote control system (Potential free contact)
c. Open feedback from actuator to remote control system (Potential free contact).
d. Close feedback from actuator to remote control system (Potential free contact)

8.0 Actuator shall also be suitable for remote operation by potential free contacts for open / close and stop, the necessary 24V DC power supply shall be derived internally.

9.0 Space heater supply shall be derived internally

10.0 DOCUMENTS TO BE SUBMITTED ALONG WITH OFFER :

a. Bill of material and control circuit diagram incorporating all standard starter components.

b. Actuator GA & cross sectional drawing.

" ELECTRICAL ACTUATOR DATA SHEET "

(VENDOR TO COMPLETELY FILL UP AND FURNISH COPIES ALONG WITH OFFER)

ABSENCE OF ANY DETAIL WILL BE CONSTRUED AS NON REPONSIVE OFFER AND LIABLE FOR REJECTION.

SPECIFY TOLERANCE WHEREVER APPLICABLE - (REQUIRED TO BE CHECKED DURING TESTING / INSPECTION)

SL.NO	SPECIFICATION REQUIREMENT	ACTUATOR SL.NO			
		001	002	003	004
1.0	Actuator type chosen.				
	MOTOR:				
2.0	Type & frame size.				
2.1	Rating (Voltage / KW)				
2.2	Starting current. (A)				
2.3	Current at run torque (15 min. torque for louver & 6 min. torque for gate).				
2.4	Full load current (at 100% Torque setting)				
2.5	Current at dynamic stall (Locked rotor)				
2.6	Permissible locked rotor withstand time.				
2.7	A. Starting Torque				

VENDOR SIGNATURE:

SL.NO.	SPECIFICATION REQUIREMENT	ACTUATOR SL.NO .			
		001	002	003	004
	B. Run Torque.				
	C. Class of Insulation.				
	D. Stator winding Star or Delta. (Delta Preferable)				
2.8	Full load torque (100 % Torque setting).				
2.9	A. No. Of starts per Hr at no load condition.				
	B. No. Of starts per Hr with load at specified run Torque.				
	C. Full load RPM.				
	D. Ambient temp. in ° C (- 20° C to + 50° C)				
	E. Duty time (S2-15min.)				
	F. Full load power factor.				
	G. Full load efficiency.				
	H. OLR set value				
	GEAR BOX :				
3.0	A. Primary Gear Box Ratio.				
	B. Primary Gear Box Efficiency.				
3.1	Primary GB maximum output torque (KGM)				

VENDOR SIGNATURE:

SL.NO.	SPECIFICATION REQUIREMENT	ACTUATOR SL.NO.			
		001	002	003	004
4.0	A. Secondary GB type & make. B. Secondary GB Ratio. C. Secondary GB efficiency.				
4.1	Secondary GB maximum torque (KGM)				
4.2	A. Secondary GB continuous torque capacity (kgm). B. Secondary GB momentary torque capacity (kgm).				
5.0	Actuator + Secondary GB output RPM .				
5.1	A. Actuator + Secondary GB output torque (KGM) (15 min. torque for louver & 6 min. for gate.) B. Secondary GB lead angle less than or equal to 6° . C. Worm & worm wheel material.				
5.2	Actuator + Secondary GB starting torque (KGM).				
5.3	Actuator + Secondary GB dynamic stall torque (KGM).				
5.4	Bore Dia. x length of Secondary GB (mm).				
5.5	Approximate Weight of actuator + Secondary GB.				

VENDOR SIGNATURE:

SL.NO.	SPECIFICATION REQUIREMENT	ACTUATOR SL.NO.			
		001	002	003	004
5.6	Lubrication : A. Recommended interval of checking/ filling. B. Type of lubricant. C. Indian equivalent make. D. Qty. in Litres / Kg .				
5.7	Type and make of Limit switches and Torque switches.				
5.8	Actuator + Secondary GB paint. A. Colour. B. Paint thickness.				
5.9.	Number of 9 pin plug and sockets provided for control cables.				
6.0.	Wiring Diagram				

VENDOR SIGNATURE:

PI-57570

PROFORMA INVOICE / PRICE BID for FGD Outlet Gate

PROJECT : NTPC Vindhyachal #13 – 1 x 500 MW (R549) , ENQUIRY NO:_____

The scope of supply shall mandatorily cover the following items and the "Quantities" indicated against each item description in the table.

Sl. No.	ITEM DESCRIPTION	Unit Rate	Enquiry Quantity	Total Price
1	FGD OUTLET GATE with Electrical Actuator Assembly as per specification GDRS: 017, Clause no. 3.0 & 19.0		1 set	
2	Mandatory spares consisting of : i) 1 no. Electrical actuator (excluding gear box) for the Gate ii) 1 set of seals (set means for complete replacement in 1 Gate)		1 set	
3	Leak tightness type test charges (on Volumetric flow)		1	
4	Erection & commissioning support as per clause nos. 6.2, 6.3 and 16.0 of GDRS: 017		1	
5	Grand Total price for above scope (sl nos. 1 to 4)			

Note:
In unpriced PRICE BID, bidder has to indicate “Quoted” against the columns “Unit Rate” and “Total Price” in above Table. The numerical values (Price) for all the above to be quoted in “price bid” only. No conditional clause shall be inserted into price bid by bidder. Any conditions added in price bid will cause rejection of bidder’s offer. Certified that all items indicated in above table are covered in scope of supply.

BIDDER’s SIGNATURE :

BIDDER’s SEAL :

CL-GT-57570

CHECKLIST for FGD Outlet Guillotine Gate (Vindhyachal 500 MW, R549)

(Vendor shall submit this checklist duly filled along with Technical offer**)**

Sl. no:	DOCUMENTS	Furnished status / Confirmation (Yes/No)
1	Respective Data sheets i) DS-57570 & ii)TDA: NTPC: DAE: OCIS. Rev.03	
2	Comments /Acceptance/Deviations against the General specification as per GDRS: 017	
3	Proforma Invoice – PI-57570 filled and enclosed and all items as per cl.no.3.0 of GDRS: 017 included in scope of supply.	
4	Mandatory spares (Actuator without gear box & set of seals) price considered in the proforma Invoice PI-57570	
5	Leak tightness test charges considered in the proforma Invoice PI-57570 for one gate	
6	Erection and commissioning support charges confirming to cl.nos. 6.2, 6.3 & 16.0 in Technical specification GDRS: 017 First visit - for erection, second visit - 2 days for commissioning considered in Proforma Invoice PI-57570, sl.no.4	
7	Scope of supply clearly indicating terminal points & exclusions.	
8	General arrangement drawing enclosed with Technical offer showing: a) Overall Dimensions of gate with all accessories with BOM, b) Material of construction, c) Split / modular details , d) Seals arrangement on all the four sides , e) Blade construction detail & f) weight details.	
9	i)Quality plan in line with BHEL QP & ii) filled up NTPC format no. QS-01-QAI-P-04/ F2-R1 (7 pages) enclosed	
10	Spares list quoted & valid for a period of 3 years: a) Commissioning spares b) Recommended spares for three years trouble free operation	
11	Reference list details & G.A. drawings satisfying the Qualification Requirements enclosed as per cl. No. 14.0 (c) & (d) of GDRS: 017	
12	Vendor confirmation for submission of specified drawing / document for approval (as specified in the general specification GDRS: 017 clause no. 21.2, 21.3 & 21.4) after placement of purchase order	
13	Bidder's confirmation of leak tightness testing to meet ≥ 99.80% efficiency without seal air and 100% with seal air by volumetric flow method and as per enclosure G&D:LTTP (7 pages)	
14	Confirmation to painting requirement as per PS VINDHYACHAL R549 REV.00 .dt. 16.08.2012 (1 page)	
15	Confirmation that Guillotine Gate proposed is of Modular/ dismantlable design for transportation & Assembly at site.	
16	Confirmation that all Instrumentation as specified in GDRS: 017 & BHEL P&ID : 4610-101-04RP and Inst_Spec-57570 are supplied in vendor scope.	
17	Confirmation that Electrical Heater can be switched off when the Gate Blade is in Open condition (FGD in operation) and none of the flue gas exposed parts will be subject to corrosion (as per cl. No. 20.0 (A))	