

**ANNEXURE –C to Global tender ENQ. No. BAP/PUR /GATES & DAMPERS/7230980E dt.22.10.2013**

S.NO	MATERIAL CODE	ITEM DESCRIPTION	SPECIFICATION REFERENCE	QUANTITY (NO)	DESTINATION
1	R57307460001	HOT AIR GATE FOR DUCT WIDTH 1835MM X HEIGHT 1835MM WITH PNEUMATIC ACTUATOR AS PER SPECIFICATION REF GDRS 012 AND DATA SHEET DS 57270	SPECIFICATION REF GDRS 012 AND DATA SHEET DS 57270	18	BHEL STORES RANIPET
2	R57307450001	COLD AIR GATE FOR DUCT WIDTH 1100MM X HEIGHT 1100MM WITH PNEUMATIC ACTUATOR AS PER SPECIFICATION REF GDRS 012 AND DATA SHEET DS 57160	SPECIFICATION REF GDRS 012 AND DATA SHEET DS 57160	18	BHEL STORES RANIPET
3	R57307420001	PA FAN OUTLET GATE FOR DUCT WIDTH 3450MM X HEIGHT 3450MM WITH ELECTRIC ACTUATOR AS PER SPECIFICATION REF GDRS 012 AND DATA SHEET DS 57110	SPECIFICATION REF GDRS 012 AND DATA SHEET DS 57110	4	BHEL STORES RANIPET



**Bharat Heavy Electricals Ltd**  
**Boiler Auxiliaries Plant**

**TECHNICAL DOSSIER for 57-110**

**PA- FAN OUTLET GATE**

EDC- Gates &  
Dampers

Ranipet-632 406



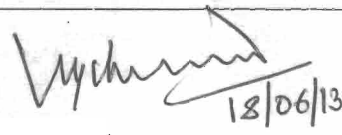
NTPC MOUDA STAGE-II - 2 X660MW

PAGE NO 01 OF 01

SINo	Particulars	Document reference
1	Data sheet- PA fan outlet Guillotine Gate	DS -- 57110
2	General specification of guillotine gate	GDRS: 012
3	Proforma invoice- PA fan outlet gate	PI -- 57110
4	Document Submission Check list	CL-GT
5	Specification for Electrical damper Actuators	TDA : NTPC :DAE:OCIS / Rev.02
6	BHEL Quality Plan	R501/04
7	Painting schedule	PR :QA:588/03
8	Type test procedure	G&D LTTP

Record of Revisions:

Rev. 00.dt. 18/ 6/ 2013 : Original Issue

Prepared	Checked	Approved
	 18/6/2013	 18/06/13
<b>V. KESAVAN</b> Manager -EDC /G&D	<b>D. ASHWIN DHINAKAR</b> Sr. Manager - EDC /G&D	<b>J. RAVISANKAR</b> Sr. DGM - EDC /G&D

Project: NTPC Mouda(2x660 MW) Required Quantity=2 nos per boiler

SL no	Description	Requirement	Vendor Comments / Acceptance / Deviations
1	Scope of supply	Supply of Guillotine Gate	
2	Gate size particulars	Duct inside dimension in mm <b>3450x3450</b>	
		Gate frame depth 400mm approx	
		Drive mechanism - Rack and pinion / Chain & Sprocket	
		Blade movement - Mechanical locking to be provided on both open & close positions	
3	Electric Actuator	Electric actuator with integral starter as per spec <b>TDA:NTPC:DAE:OCIS / Rev 02</b>	
		Gate Actuator Make, Model No	
		Gear box make & model no	
		Actuator kilo watt rating	
		Output RPM of the secondary gear box	
		Time taken for raising / lowering gate (should be < 100 secs)	
		Actuator torque rating No load / Start/run/stall – torqueKgm	
4	Material of construction	Gate frame - Carbon steel <b>ASTM A36</b> or equivalent	
		Gate Blade- <b>ASTM A588 Gr.A</b> or better	
		Seals - <b>ASTM B575 UNS N10276</b> or <b>UNS N06625</b>	
		Shaft material- vendor to specify	
		Shaft stuffing box packing material – Non asbestos	
5	A. Design parameters for gate	Duct orientation - Horizontal; Gate orientation: - Vertical	
		Blade - Top entry	
		Duct wall thickness - <b>5mm</b>	
		Actuator position: Centrally located / One gate with LH & one gate with RH orientation	
	B. Parameters for leak tightness type testing / operating conditions	<b>Flow medium: Ambient air</b>	
		<b>Flow medium density 1.102 kg/m<sup>3</sup></b>	
		<b>Flow medium Velocity 16 m/sec</b>	
		<b>Volume of flow 152.9 m<sup>3</sup>/second per gate</b>	
		<b>Design/Operating Temperature 50°C/35°C</b>	
		<b>Design pressure: +1503 /-660 mm &amp; Operating pressure 1080 mm Water Column (gauge)</b>	

SL no	Description	Requirement	Vendor Comments / Acceptance / Deviations
6	Supply condition	knocked down / assembled condition	
		Gate assembly at site is under Vendor scope for Knocked down / modular dispatch	
7	Details to be submitted along with offer / bid	General arrangement drawing of Guillotine gate	
		Seal arrangement on all the four sides	
		Frame construction & sectional views on all four sides	
		Blade construction drawing	
		approximate overall height x width x depth of gate in mm	
		Approximate weight of each gate	
8	Quality & Routine test requirement	Vendor to comply either as per BHEL QP No: R501/04 dated 30-09-2011 or Vendor Quality plan duly approved by NTPC	
9	Type test as per Performance test procedure G&D:LTTP to be demonstrated	Guillotine gate shall have a guaranteed leak tightness efficiency (on flow) of not less than 99.95% <b>without seal air</b>	
		a) From one side of gate to other side along the duct as well as from duct to atmosphere (Gate closed position)	

VENDOR SIGNATURE :

SEAL:

PI-57110

**PROFORMA INVOICE / PRICE BID for PA Fan Outlet Gate**

**PROJECT :** NTPC MOUDA – 2X660 MW (R646 & R647) **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	PA FAN OUTLET GATE WITH ELECTRIC ACTUATOR ASSEMBLY as per specification GDRS: 012		4	
2	Mandatory spare ( Electric actuator )		1	
3	Leak tightness type test charges Volumetric flow		1	
4	Erection & commissioning support as per clause no. 12.0 of GDRS: 012		1	
5	Grand Total price for above scope (sl nos. 1 to 4)			

\*this total quantity covers the requirement of 2 boilers that is 2 x 660 MW units.

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 :



**Bharat Heavy Electricals Ltd  
Boiler Auxiliaries Plant**

**TECHNICAL DOSSIER for 57-160**

**Cold Air Gate**

EDC- Gates &  
Dampers

Ranipet-632 406


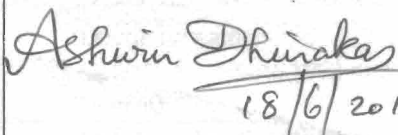
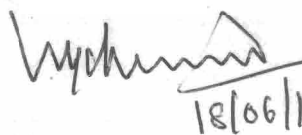
NTPC MOUDA STAGE-II - 2 X660MW

PAGE NO 01 OF 01

SINo	Particulars	Document reference
1	Data sheet- Cold Air Gate	DS – 57160
2	General specification of guillotine gate	GDRS: 012
3	Proforma invoice Cold Air Gate	PI – 57160
4	Document Submission Check list	CL-GT
5	BHEL Quality Plan	R501/04
6	Painting schedule	PR :QA:588/03
7	Type test procedure	G&D LTTP

Record of Revisions:

Rev. 00.dit. 18/ 6/ 2013 : Original Issue

Prepared	Checked	Approved
	 18/6/2013	 18/06/13
<b>V. KESAVAN</b> Manager –EDC /G&D	<b>D. ASHWIN DHINAKAR</b> Sr. Manager – EDC /G&D	<b>J. RAVISANKAR</b> Sr. DGM – EDC /G&D

Project: NTPC Mouda(2x660 MW) Required Quantity=9nos per boiler

SL no	Description	Requirement	Vendor Comments / Acceptance / Deviations
1	Scope of supply	Supply of Guillotine Gate	
2	Gate size particulars	Duct inside dimension in mm <b>1100x1100</b>	
		Gate frame depth 400mm approx	
		Drive mechanism -Pneumatic cylinder	
		Blade movement - Mechanical locking to be provided on both open & close positions	
3	Pneumatic Actuator	Torque required to operate the gate No load / Start/run/stall - torqueKgm	
		Pneumatic cylinder / Open close type	
		Cylinder bore mm	
		Cylinder stroke mm	
		Time taken for raising / lowering gate	
4	Material of construction	Gate frame - Carbon steel <b>ASTM A36</b> or equivalent	
		Gate Blade- <b>ASTM A588 Gr. A or better</b>	
		Seals - <b>ASTM B575 UNS N10276</b> or <b>UNS N06625</b>	
		Shaft material- vendor to specify	
		Shaft stuffing box packing material – Non asbestos	
5	A. Design parameters for gate	Duct orientation - Horizontal; Gate orientation: - Vertical	
		Blade - Top entry	
		Duct wall thickness - <b>5mm</b>	
		Actuator position: Centrally located / side mounted	
	B. Parameters for leak tightness type testing / operating conditions	<b>Flow medium: Primary air line</b>	
		<b>Flow medium density 1.102 kg/m<sup>3</sup></b>	
		<b>Flow medium Velocity 16 m/sec</b>	
		<b>Volume of flow 18.9 m<sup>3</sup>/second per gate</b>	
		<b>Design/Operating Temperature 275°C/35°C</b>	
		<b>Design pressure: +1503 /-660 mm &amp; Operating pressure 1080 mmWater Column (gauge)</b>	
6	Supply condition	knocked down / assembled condition	
		Gate assembly at site is under Vendor scope for Knocked down / modular dispatch	

SL no	Description	Requirement	Vendor Comments / Acceptance / Deviations
7	Details to be submitted along with offer / bid	General arrangement drawing of Guillotine gate	
		Seal arrangement on all the four sides	
		Frame construction & sectional views on all four sides	
		Blade construction drawing	
		approximate overall height x width x depth of gate in mm	
		Approximate weight of each gate	
8	Quality & Routine test requirement	Vendor to comply either as per BHEL QP No: R501/04 dated 30-09-2011 or Vendor Quality plan duly approved by NTPC	
9	Type test as per Performance test procedure G&D:LTTP to be demonstrated	Guillotine gate shall have a guaranteed leak tightness efficiency (on flow) of not less than 99.95% <b>without seal air</b>	
		a) From one side of gate to other side along the duct as well as from duct to atmosphere (Gate closed position)	
10	Instrument Air consumption for Pneumatic Actuator	Max. air pressure available at Terminal point = 4.5 kg/sq./cm(g). Vendor to indicate Total Air requirement for 1 Close to Open Stroke of Gate in Nm <sup>3</sup>	

VENDOR SIGNATURE :

SEAL:

PI-57160

PROFORMA INVOICE / PRICE BID for Cold Air Gate

PROJECT : NTPC MOUDA – 2X660 MW (R646 & R647) 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	Cold Air Gate GATE WITH Pneumatic ACTUATOR ASSEMBLY as per specification GDRS: 012		18	
2	Leak tightness type test charges Volumetric flow		1	
3	Erection & commissioning support as per clause no. 12.0 of GDRS: 012		1	
4	Grand Total price for above scope (sl nos. 1 to 3)			

\*this total quantity covers the requirement of 2 boilers that is 2 x 660 MW units.

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 :



**Bharat Heavy Electricals Ltd  
Boiler Auxiliaries Plant**

**TECHNICAL DOSSIER for 57-270**

**Hot Air Gate**

EDC- Gates &  
Dampers

Ranipet-632 406


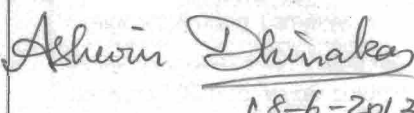

NTPC MOUDA STAGE-II - 2 X660MW

PAGE NO 01 OF 01

SINo	Particulars	Document reference
1	Data sheet- Hot Air Gate	DS – 57270
2	General specification of guillotine gate	GDRS: 012
3	Proforma invoice Hot Air Gate	PI – 57270
4	Document Submission Check list	CL-GT
5	BHEL Quality Plan	R501/04
6	Painting schedule	PR :QA:588/03
7	Type test procedure	G&D LTTP

Record of Revisions:

Rev. 00.dt. 18/ 6/ 2013 : Original Issue

Prepared	Checked	Approved
	 18-6-2013	 18/06/13
<b>V. KESAVAN</b> Manager –EDC /G&D	<b>D. ASHWIN DHINAKAR</b> Sr. Manager – EDC /G&D	<b>J. RAVISANKAR</b> Sr. DGM – EDC /G&D

Project: NTPC Mouda(2x660 MW) Required Quantity=9nos per boiler

SL no	Description	Requirement	Vendor Comments / Acceptance / Deviations
1	Scope of supply	Supply of Guillotine Gate	
2	Gate size particulars	Duct inside dimension in mm <b>1835 x 1835</b>	
		Gate frame depth 400mm approx	
		Drive mechanism -Pneumatic cylinder	
		Blade movement - Mechanical locking to be provided on both open & close positions	
		<b>Seal air entry provision with manually operated isolation valve</b>	
3	Pneumatic Actuator	Torque required to operate the gate No load / Start/run/stall - torqueKgm	
		Pneumatic cylinder / Open close type	
		Cylinder bore mm& Stroke mm	
		Time taken for raising / lowering gate	
4	Material of construction	Gate frame - Carbon steel <b>ASTM A36</b> or equivalent	
		Gate Blade- <b>ASTM A588 Gr.A</b> or better	
		<b>Seals - ASTM B575 UNS N10276</b> or <b>UNS N06625</b>	
		Shaft material- vendor to specify	
		Shaft stuffing box packing material – Non asbestos	
5	A. Design parameters for gate	Duct orientation - Horizontal; Gate orientation: - Vertical	
		Blade - Top entry	
		Duct wall thickness - <b>6mm</b>	
		Actuator position: Centrally located / side mounted	
	B. Parameters for leak tightness type testing / operating conditions	<b>Flow medium: Primary air line</b>	
		<b>Flow medium density 0.62 kg/m<sup>3</sup></b>	
		<b>Flow medium Velocity 16 m/sec</b>	
		<b>Volume of flow 49.4 m<sup>3</sup>/second per gate</b>	
		Design/Operating Temperature <b>400°C/275°C</b>	
		Design pressure: <b>+807 /-660 mm</b> & Operating pressure <b>807 mm</b> water column (gauge)	
		Seal Air Blower pressure to seal air chamber in mm WC to demonstrate 100% Leak tightness efficiency ( On-flow) at vendor works	
6	Supply condition	knocked down / assembled condition	
		Gate assembly at site is under Vendor scope for Knocked down / modular dispatch	

SL no	Description	Requirement	Vendor Comments / Acceptance / Deviations
7	Details to be submitted along with offer / bid	General arrangement drawing of Guillotine gate	
		Seal arrangement on all the four sides	
		Frame construction & sectional views on all four sides	
		Blade construction drawing	
		approximate overall height x width x depth of gate in mm	
		Approximate weight of each gate	
8	Quality & Routine test requirement	Vendor to comply either as per BHEL QP No: R501/04 dated 30-09-2011 or Vendor Quality plan duly approved by NTPC	
9	Type test as per Performance test procedure G&D:LTTP to be demonstrated	Guillotine gate shall have a guaranteed leak tightness efficiency (on flow) of not less than 99.95% <b>without seal air</b>	
		a) From one side of gate to other side along the duct as well as from duct to atmosphere (Gate closed position)	
10	Instrument Air consumption for Pneumatic Actuator	Max. air pressure available at Terminal point = 4.5 kg/sq./cm(g). Vendor to indicate Total Air requirement for 1 Close to Open Stroke of Gate in Nm <sup>3</sup>	
11	Seal Air pipe & Valve Details	Vendor to indicate seal air pipe size "OD x t" in mm to match vendor scope of supply, type of manual isolating valve, size and Class / Rating	

VENDOR SIGNATURE :  
SEAL:

PI-57270

**PROFORMA INVOICE / PRICE BID for Hot Air Gate**

**PROJECT :** NTPC MOUDA – 2X660 MW (R646 & R647) **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	Hot Air Gate WITH Pneumatic ACTUATOR ASSEMBLY as per specification GDRS: 012		18	
2	Leak tightness type test charges Volumetric flow		1	
3	Erection & commissioning support as per clause no. 12.0 of GDRS: 012		1	
4	Grand Total price for above scope (sl nos. 1 to 3)			

\*this total quantity covers the requirement of 2 boilers that is 2 x 660 MW units.

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**  
**CHECKLIST for Guillotine Gates**

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

Sl. no:	DOCUMENTS	Furnished status (Yes/No)
1	Acceptance/comments/Deviation of respective Data sheet	
2	Comments /acceptance/Deviations against the General specification as per GDRS: 012	
3	Respective Proforma Invoice filled and enclosed	
4	Mandatory spares (Actuator) price considered in the proforma for one actuator	
5	Leak tightness test charges considered in the proforma for one gate	
6	Erection and commissioning supervision charges for first gate: First visit - 4 days for erection, second visit - 2 days for commissioning considered in Proforma Invoice	
7	Scope of supply clearly indicating terminal points & exclusions.	
8	General arrangement drawing with a) Overall Dimensions of gate 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	Quality plan	
10	Spares list: a) Commissioning spares b) Recommended spares for three yearstrouble free operation	
11	Reference list of similar supplies	
12	Performance feedback certificate	
13	Vendor confirmation for submission of specified drawing / document for approval (as specified in the general specification GDRS: 012 clause no. 16.0, 16.1 & 16.2) after placement of purchase order	
14	1 set of seal for complete replacement of one gate - vendor to quote with separate sheet , price valid for 3 years from offer	
15	Bidder's confirmation of leak tightness testing to meet 99.95% efficiency without seal air by volumetric flow method and as per enclosure G&D:LTTP	
16	Bidder's confirmation of leak tightness testing to meet 100% efficiency with seal air by volumetric flow method as specified in 7.0(d) of GDRS: 012 for ESP Inlet, ESP Outlet, ID Fan Inlet & Hot Air Gates and as per enclosure G&D:LTTP	
17	Confirmation to painting requirement as per PRQA: 588/03 (page 11 of 12)	

GDRS:012  
GUILLOTINE GATE - GENERAL SPECIFICATION

**1.0) Scope of supply:**

Design, Manufacture, Testing, Painting & Packing for Shipment and supervision for erection and commissioning including :

**a) Guillotine gate assembly:** with actuator

**b) Mandatory spares:**

i. 1 no of actuator (for electrical operated gates only)

**2.0) Operation requirement:**

Gate has to meet a guaranteed gas tightness efficiency ( on flow) of not less than 99.95% along the duct as well as from the duct to atmosphere or from atmosphere to the duct, as per the specified pressure indicated in data sheets in gate closed condition without the use of seal air during Type test. In addition to the above for Hot air gates, leak tightness efficiency of 100% with seal air blower shall be demonstrated during Type test.( Refer Clause 7.0 (d) )

**3.0) Construction Details :**

**3.1) Drive mechanism for Electrically operated Gates:** Rack & pinion / Chain & Sprocket.

**3.2) Split / modular design:** Gate size being larger, it may not be possible to dispatch as single piece, Hence split / modular design may be acceptable. Vendor has to specify the method of construction & mounting details with the offer.

**3.3) Casing:-**Casing shall be fabricated to the dimension as per the data sheet with suitable thickness. 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

**3.4) Locking device:** Manual locking device shall be provided both at full open and full close positions.

**3.5) Blades:** - Blades are designed in such a way that it should have deflection resistant configuration and have suitable thickness to withstand the pressure given in the data sheet.

**3.6) Shaft:** - Suitable material shall be selected to withstand the high torque.

**3.7) Stuffing Boxes:** Specially designed stuffing box with suitable seal materials

**3.8) Bearings:-** Suitably designed maintenance free bearing are to be provided

**3.9) Seal air chamber:** Provision to be made available on all the four sides of gate wherever seal air is applicable. Seal air is applicable for Hot Air Gates.

## GUILLOTINE GATE - GENERAL SPECIFICATION

Seal air inlet connection details like location, pipe ID, OD, flange thickness, flange PCD to be provided by vendor

**3.10) Ash collection space:** Provision for ash cleaning/poking recess to be provided at the bottom and sides of seals for the applicable cases.

### **3.11) Other Technical/Operational Requirements:**

i) For open and close feedback of hot air gates, Proximity (i.e. non contact) type limit switches (2 NO + 2 NC) shall be provided. These shall be suitable for working in hot & dusty environment.

ii) Weather hood to prevent rainwater entry & accumulation shall be provided on top of each gate.

iii) Open and Closed positions shall be clearly marked on the gates.

iv) All gates shall be arranged to facilitate local manual operation also from a gallery or floor level.

v) The force required to operate the gate shall be limited to 35 kg (maximum) at the rim of the hand wheel.

vi) All the gates shall also have provision for manual operation during emergency/maintenance along with graduated local position indicator.

### **4.0) Material of Construction:-**

a) Frame: Carbon steel ASTM A36 or equivalent

b) Blade: ASTM A588 or better material

c) Rack & pinion / Chain & Sprocket materials to be specified by the vendor

d) Seals:- HASTELLOY Alloy C-276 (ASTM B575 UNS N10276) or UNS N006625.

The seal design shall meet the specified leak tightness efficiency at the specified operation conditions & it has to serve for minimum three years before next replacement

#### Note for Materials offered :

If alternate materials are offered like JIS, DIN etc., other than ASTM indicated in our specification / data sheet, then vendor has to indicate nearest equivalent ASTM material codes in addition to their offered codes with chemical composition for our review. 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.

Note: Chinese standard for materials are not acceptable

**5.0) Actuator System:** (with Secondary Gear box with splined bush – worm gear & self locking. Also refer Actuator spec TDA : NTPC: DAE: OCIS, Rev.02)

Electric actuator with manual hand operated wheel for manual open/ close. The force required to operate manually shall be within 35kgf at the wheel rim. Vendor shall furnish actuator details like make, model, KW rating, output RPM, sizing torque, run

## GDRS:012

### GUILLOTINE GATE - GENERAL SPECIFICATION

torque, stall torque. Actuator is suitable for 3 phase power supply, 50 Hz & 415 V AC. The time taken for raising and lowering gate shall be furnished by the vendor. The actuator shall be equipped with Integral starter, limit switches. The timing for full close & full open and also from full open to full close should not exceed 100 seconds for PA Fan Outlet Gate.

In case of Cold air gates and Hot air gates, the actuator should be of pneumatic open / close type with closing time  $\leq 12$  seconds per meter stroke length. The actuator can be either single cylinder top mounted or twin cylinders mounted at both sides of gate. The design offered by the vendor shall be well proven for trouble free operation in actual site operation.

The solenoid valve 24V DC, Air Filter Regulator, Limit switches ( 2 for Open & 2 for Close of 2 NO + 2NC type) and separate Junction Box are also in vendor scope of supply. All the Terminals of the Limit switches and Solenoid valve shall be terminated in the Junction Box mounted in the Gate Assembly at an approachable location. (The Air Tank / Receiver shall however be supplied by the Purchaser. The successful vendor shall however furnish the sizes of Air Tank / Receiver or check the suitability of BHEL design Air Tank in meeting the vendor's design and confirm after the placement of Purchase Order.) The supply pressure at Terminal point of Air Tank will be 4.5 kg/sq.cm(g) and pneumatic pipe size will be 1".

#### **6.0) Painting requirements :**

Refer PROA 588 page 11 of 12

Painting is not applicable for Galvanized, Non-ferrous material, stainless steel surface, C276 seals & cladding surfaces

#### **7.0) Quality plan & Testing:**

a) Vendor 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. The inspection shall be as per the approved quality plan.

b) Vendor has to submit GA drawing of gate assembly showing all important dimension 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 constriction & sectional views on all four sides. Actuator location, platform requirement & arrangement, 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 is to be prepared in line with BHEL/Ranipet test procedure No G&D:LTPP and same shall be submitted for customer approval with drawing showing the test set up and sample calculations.

GDRS:012  
GUILLOTINE GATE - GENERAL SPECIFICATION

d) **The break up price for performing** the type test as per the above procedure (test without seal air and with seal air as applicable is to be indicated. The guillotine gate has to be tested with volumetric flow method. In this method guillotine gate has to meet minimum 99.95% leak tightness efficiency without seal air and 100% leak tightness with seal air as applicable for gates having seal air connections.

In case of Hot Air Gates, the upstream pressure as indicated in Datasheet should be supplied in Gate closed condition for proving 99.95% leak tightness efficiency( without seal air). For proving 100% leak tightness efficiency seal air chamber is to be supplied with a pressure not exceeding 125 mm WC ( approx.) above the upstream pressure indicated in datasheet and the measured leak tightness efficiency should be 100%.

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.

e) Vendor has to give 15 days' advance intimation for witnessing of leak tightness type test for making travel arrangement.

f) The above test should be conducted at manufacturer's works. Vendor shall make their own arrangements for test stand, test equipment like blowers, 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 (as applicable) 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.

**8.0) 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 during transit & handling. Transport stiffeners should be painted yellow.

Description, quantity & weight details of each item have to be neatly marked on each crate.

Overall Transportation Limitations for Indian Roads ( for guidance )

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

GDRS:012  
GUILLOTINE GATE - GENERAL SPECIFICATION

Vendor shall submit shipping bill of material with packages, identified with overall size, quantity and weight (maximum dimension of consignment which can be transported in Indian roads). Overall dimensions shall be as per transport limitations furnished above.

**9.0) Knocked Down shipment**

If the gate / damper is shipped to project site in knocked down condition, complete assembly (including consumables for welding / bolting etc) and handing over to BHEL erection is to be done by vendor during supervision of erection. This is applicable to all units supplied by the vendor. This is to be covered in the vendor's base price and not an Optional requirement. This shall be done during the erection supervision by the vendor at site. Vendor will have to make their own boarding & lodging arrangements during this period.

**10.0) Bidder's Experience**

Bidders should have engineered, manufactured and supplied similar design gates and of closer sizes for coal fired boiler which has completed minimum two years of trouble free operation in any power plant in India / abroad.

Bidders have to provide their customer reference and satisfactory performance feedback certificate in end user letter head from 2 end users for same application using same design. The reference list should contain the name of power plant, capacity of each plant in MW, application of gate, Purchase order & date, date of commissioning, size of gate (height x width/blade length), Actuator details, leak tightness efficiency without seal air), assembly weight, single or split construction, material of construction (shaft, seals, blade), design and operating pressure & temperature, blower details (flow, pressure & KW).

**10.1) Qualification requirement (Offer acceptance criteria)**

Non compliance to leak tightness efficiency of 99.95% (by volumetric flow without seal air as BHEL test procedure No: G&D:LTTP/dt:01-02-2012) will lead to rejection of offer & the same will not be considered for further evaluation

**11.0) Responsibility**

The extent of supply stated herein 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

## GUILLOTINE GATE - GENERAL SPECIFICATION

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.

### **12.0) Assistance for Erection & Commissioning :**

The Bidder shall quote separate breakup price per diem basis for support to be rendered during erection / commissioning of the gates at Indian site for first unit. The vendor has to offer supervision support during erection for 4 days at site in the first visit and 2 days at site for commissioning in the second visit. Payment will be made on certification by site engineer on satisfactory completion of support. Vendor will have to make their own boarding & lodging arrangement during this period.

### **13.0) Spares :**

The Bidder shall offer for the following.

- a. Commissioning spares (to be supplied at no extra cost to BHEL to enable smooth commissioning)
- b. Recommended spares for 3 years operation – Quantity with unit rate
- c. Mandatory spares - 1 number of actuator (applicable only for electrically operated gates)

### **14) Special Tools :**

The Gates shall be designed to be assembled, disassembled and maintained with standard hand tools. However, if 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".

## GUILLOTINE GATE - GENERAL SPECIFICATION

**15) Project Information**

<b>Sl no</b>	<b>PROJECT INFORMATION</b>	
<b>1</b>	▪ Owner	NTPC Ltd.
<b>2</b>	▪ Buyer	BHEL, Ranipet
<b>SITE CONDITIONS</b>		
<b>3</b>	▪ Wind speed	44 m/s
<b>4</b>	▪ Ambient temperature (Guarantee )	27 Deg C
<b>5</b>	▪ Ambient temperature ( Design)	50 Deg C (maximum) 6 Deg C (minimum)
<b>6</b>	▪ Relative Humidity	60%
<b>LOCATION AND APPROACH</b>		
<b>7</b>	▪ Project location	Mouda Tehsil
<b>8</b>	▪ District	Nagpur Dist
<b>9</b>	▪ State	Maharashtra
<b>10</b>	▪ Height above sea level	271.5 m

GDRS:012  
GUILLOTINE GATE - GENERAL SPECIFICATION

**16.0) 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.**

SI No	Documents	No. of Copies required	Vendor acceptance comments / deviation
1	Final Quality plan	1	
2	Test Setup & procedure for Leak tightness test	1	
3	i) Technical Data sheet for referred gate service (final) ii) General Assembly drawing showing major components & dimensions iii) Drawing showing sealing arrangement and components requiring replacement/ service during maintenance with BOM and dimensions	1each	
4	Final Actuator data sheet	1	
5	Basic engineering transmittal for approach and platform for maintenance of actuator / gate accessories to enable BHEL to manufacture and supply	1	
6	Drawing of mating flanges of guillotine gates on both sides to enable BHEL to manufacture and supply	1	
7	Details of seal air pipe size and Manual Isolating valve type to enable BHEL to supply seal air connection with isolation valve ( for ESP Inlet, Outlet, ID Fan inlet and Hot Air Gate services)	1	
8	Details of Air supply / consumption required during one stroke of open/ close for Cold Air / Hot Air gate & sizes of pneumatic tubing to enable BHEL to supply Air Tank/ Receiver & pneumatic fittings	1	

GDRS:012  
GUILLOTINE GATE - GENERAL SPECIFICATION

**16.1) Documents to be submitted before dispatch**

SI No	Documents	No. of Copies required	Vendor acceptance comments / deviation
1	Complete inspection / test records of gates	2	
2	Leak tightness test reports	2	
3	Raw material Test Certificates	2	
4	Packing drawing & specification	2	
5	Erection drawing & Erection manual (in English for gate& Actuator)	3	

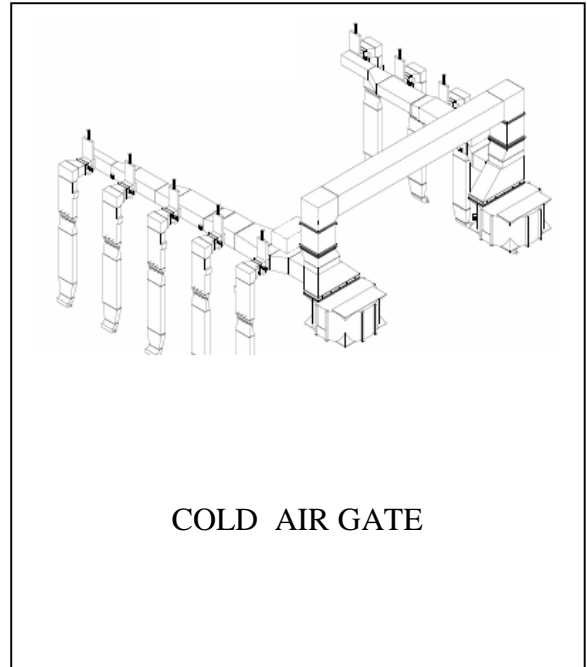
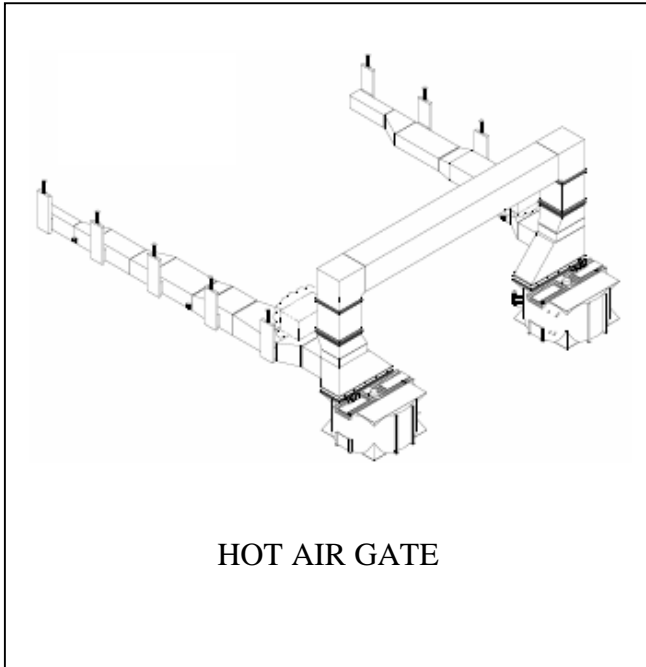
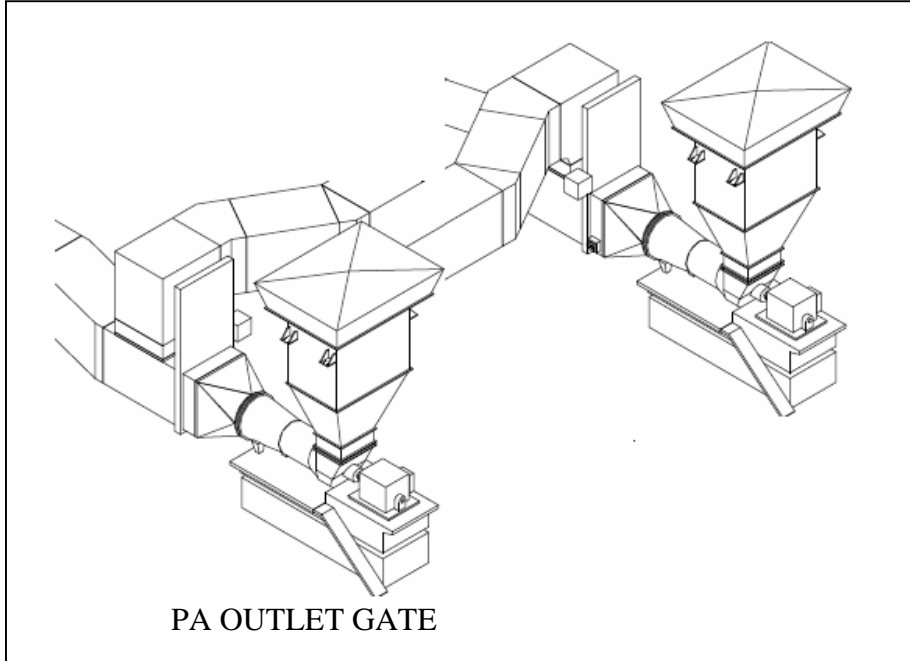
**16.2) Documents to be submitted along with Dispatch**

SI No	Documents	No. of 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	

Note: Soft copy of above documents shall also be submitted.

GUILLOTINE GATE - GENERAL SPECIFICATION

17.0) Gate Arrangement





**BHARAT HEAVY ELECTRICALS LIMITED**  
**BOILER AUXILIARIES PLANT**  
ELECTRICAL, CONTROLS AND INSTRUMENTATION  
RANIPET - 632 406.

TDA:NTPC:DAE:OCIS  
REV. 02  
SHEET 1 OF 13

**SPECIFICATION**  
**FOR**  
**ELECTRIC DAMPER ACTUATORS**  
**(OPEN/CLOSE TYPE)**  
**WITH INTEGRAL STARTERS**

REV. NO.	DATE	DESCRIPTION	PREPARED	REVIEWED	APPROVED
00	27.12.2007	<b>INITIAL RELEASE</b> 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-



**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.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 which ever is longer.

**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 suitable 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  $\pm 10\%$  of the rated value of 415 V.
- b. If the frequency of the power source varies within  $\pm 5\%$  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.3 INSULATION**

- M.3.1 Motor shall have class B insulation with tropicalisation 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. Hardware 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  $\leq 2.5\text{VA}$ , 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 RESPONSIVE 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. <b><u>MOTOR:</u></b>				
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
2.8	B. Run Torque. C. Class of Insulation. D. Stator winding Star or Delta. ( Delta Preferable) 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				
3.0	<b><u>GEAR BOX :</u></b> A. Primary Gear Box Ratio. B. Primary Gear Box Efficiency.				
3.1	Primary GB maximum output torque (KGM)				

VENDOR SIGNATURE :



**BHARAT HEAVY ELECTRICALS LIMITED**  
**BOILER AUXILIARIES PLANT**  
ELECTRICAL, CONTROLS AND INSTRUMENTATION  
RANIPET - 632 406.

TDA:NTPC:DAE:OCIS  
REV. 02  
SHEET 12 OF 13

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:**



**BHARAT HEAVY ELECTRICALS LIMITED**  
**BOILER AUXILIARIES PLANT**  
ELECTRICAL, CONTROLS AND INSTRUMENTATION  
RANIPET - 632 406.

TDA:NTPC:DAE:OCIS  
REV. 02  
SHEET 13 OF 13

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:**


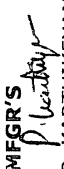
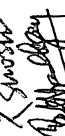
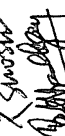
		MANUFACTURER'S NAME AND ADDRESS M/S BHEL RANIPET 632 406 TAMIL NADU		ITEM /EQUIPMENT: G&D SUB-SYSTEM: GUILLOTINE GATE ASSY.		Qp NO REV/ DATE PAGE NO		R501 04/30 09 11 1 OF 5		SIGN. OF MFR'S P. KARTHIKEYAN MANAGER / QA		TO BE FILLED BY NTPC	
REVISED BY		REVISED BY		REVISED BY		REVISED BY		REVISED BY		REVISED BY		REVISED BY	
Qp NO.: 0000-999-QVM-P-267		REV NO/DATE: 03/DT 30092011		PAGE NO.: 1 of 5		VALID UP TO: 29.09.2014		REFERENCE DOCUMENT#		ACCEPTANCE NORMS		FORMAT OF RECORD	
SL. NO		COMPONENT & OPERATIONS		CHARACTERISTICS		CLASS		TYPE OF CHECK		QUANTUM OF CHECK		AGENCY	
1.		2.		3.		4.		5.		6.		7.	
												8.	
												9.	
												10.	
												11.	

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

<b>LEGEND:</b> * RECORDS, IDENTIFIED 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 COLUMN "N" AS 'W'	
Format No.: QS-01-QAI-P-10/F1-R1	
Note: # NTPC Inspection Engineer to check, Approval Date/Revision No. of reference documents at the time of inspection	

 <b>Ranipet</b>		<b>MANUFACTURER'S NAME AND ADDRESS</b> M/S BHEL RANIPET 632 406 TAMIL NADU		<b>ITEM / EQUIPMENT:</b> G&D SUB-SYSTEM: GUILLOTINE GATE ASSY.		<b>QP NO</b> REV/ DATE PAGE NO		<b>R501</b> 04/30 09 11 2 OF 5		<b>SIGN. OF MFR'S</b>  P. KARTHIKEYAN MANAGER / QA		<b>TO BE FILLED BY NTPC</b> QP NO.: 0000-999-QVM-P-267 REV NO/DATE: 03/DT 30092011 PAGE NO.: 2 of 5 VALID UP TO: 04.03.2014		<b>REVIEWED BY</b>  P. Karthikeyan		<b>APPROVED BY</b>  P. Karthikeyan	
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT#	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY	REMARKS							
1.	2.	3.	4.	5.	6.	7.	8.	D	** 10.	11.							

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	<b>Final inspection</b>	Free operation.	Major	Open and close Movement	100%	100%	Drawing & Note 2 (i)	Report	✓	P	W	W
3.1	Trial operation	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
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	#

**LEGEND:** \* RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.  
 \*\* M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, W: NTPC P: PERFORM W: WITNESS V: VERIFICATION. AS  
 APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W"  
 Note: # NTPC Inspection Engineer to check, Approval Date/Revision No. of Reference documents at the time of inspection

 <b>Ranipet</b>		<b>MANUFACTURER'S NAME AND ADDRESS</b> M/S BHEL RANIPET 632 406 TAMIL NADU		<b>ITEM /EQUIPMENT:</b> G&D SUB-SYSTEM: GUILLOTINE GATE ASSY.		<b>Q.P. NO</b> REV/DATE PAGE NO		<b>R501</b> 04/30 09 11 3 OF 5		<b>SIGN. OF MFR'S</b> P. KARTHIKEYAN MANAGER / QA		<b>TO BE FILLED BY NTPC</b> QP NO.: 0000-999-QVM-P-267 REV NO/DATE: 03/DT 30092011 PAGE NO.: 3 of 5 VALID UP TO: 22.09.2014		<b>APPROVED BY</b> 	
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT#	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY	REMARKS					
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%	As per drawing All identified by "√" "under D" in QP	Report.	√	P	W	V
3.4	Painting, preservation & protection.	Finish Paint DFT	Minor Major	Visual Measurement	100% Random	Drawing As per NTPC approved Painting scheme	Report 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.

**LEGEND:** \* RECORDS, IDENTIFIED 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, CMP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W"

Format No.: QS-01-QAI-P-10/F1-R1

ENGG, DIV, /QA&I

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

MANUFACTURER'S NAME AND ADDRESS M/S BHEL RANIPET 632 406 TAMIL NADU		ITEM /EQUIPMENT: G&D SUB-SYSTEM: GUILLIOTTINE GATE ASSY.		QP NO	R501	SIGN. OF MFR'S P. KARTHIKEYAN MANAGER / QA		TO BE FILLED BY NTPC				
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT#	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY	REVIEWED BY	APPROVED BY	REMARKS
1.	2.	3.	4.	5.	6.	7.	8.	D	M   C   N	** 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-enforcement	Max 3 mm up to 19 mm. , Max 5 mm above 19 mm.

**NOTE 2 : GATE FINAL INSPECTION :-**

- Position the Gate in the Testing Stand maintaining vertically on sides & face ( flow direction ). It shall not have any twist.
- 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.
- Gate shall be operated with actuator for 5 complete cycles ( with an idle time of 10 minutes in between every two cycles)
- Record amperage, voltage, time taken for each stroke in case of electrical actuator and record air pressure and time for Pneumatic actuator
- During the test ensure that gate plate is operating freely without rubbing the throat support beam/structural members.
- 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.
- 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.
- Set the blade stopper bracket on beam and ensure the stroke length of blades and corner closing.
- Provide chain guards in position. Provide drain holes in frame and dust guard on super structure.
- 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 :-**


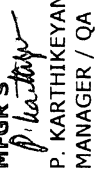

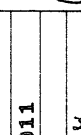
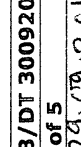
- For electrical actuators refer the NTPC approved RQP.

**LEGEND:** \* RECORDS, IDENTIFIED 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 COLUMN "N" AS 'W'

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

Format No.: QS-01-QAI-P-10/FI-R1

ENGG, DIV, /QA&I

		<b>MANUFACTURER'S NAME AND ADDRESS</b> M/S BHEL RANIPET 632 406 TAMIL NADU		<b>ITEM /EQUIPMENT:</b> G&D SUB-SYSTEM: GUILLOTINE GATE ASSY.		<b>Q.P. NO</b> REV/ DATE PAGE NO		<b>R501</b> 04/30 09 11 5 OF 5		<b>SIGN. OF MFR'S</b>  P. KARTHIKEYAN MANAGER / QA		<b>TO BE FILLED BY NTPC</b> QP NO.: 0000-999-QVM-P-267 REV NO/DATE: 03/DT 30092011 PAGE NO.: 5 of 5 VALID UP TO: 29.09.2014		<b>REVIEWED BY</b>  		<b>APPROVED BY</b> 	
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT#	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY	REMARKS							
1.	2.	3.	4.	5.	6.	7.	8.	D	M   C   N	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

**LEGEND:** \* RECORDS, IDENTIFIED 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 COLUMN "N" AS "W"

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

Format No.: QS-01-QAI-P-10/F1-R1

ENGG, DIV, /QA&I



**Bharat Heavy Electrical Limited**  
Boiler Auxiliaries Plant - RANIPET - 632 406

BHEL Doc Ref **PR:QA:588**

Rev.No. **03**

Date: **23 06 09**

**NTPC DRAWING NUMBER 9561-101-01-RN-PVM-H-002-**

03

**NTPC - MAUDA SUPER THERMAL POWER STATION 2X500 MW**

**Painting schedule for APH, ESP FAN and Gates & Damper of main boiler and FD, Chimney of Aux. Boiler  
(STEAM GENERATOR WITH ESP PACKAGE)**

**CONTRACT NO: CS- 9561 -101-2 (BHEL RANIPET WORK ORDER NUMBER R528, R529, R430)**

Prepared By	Reviewed By	Approved BY

**Issued & Controlled by: Quality Assurance**

RECORD OF REVISIONS	REV 00	Original Issue.	DT 07 07 08
	REV 01	Revised based on NTPC Comments vide Transmittal Ref : CC:PEMOU: 9561:101:01:42 DT 12 01 09	DT 22 05 09
	REV 02	Revised based on NTPC comments vide Transmittal Ref :CC: PEMOU: 9561:101:01:489 DT 03 06 09	DT 10 06 09
	REV 03	Revised based on NTPC comments vide Transmittal Ref : CC:PEMOU:9561:101:01:560 DT 18 06 09	DT 23 06 09

SI No	Surface Location	PGMA	Surface Preparation	Primer		Finish		Total DFT in (µ m) Min.	
				Paint	DFT (µm) min.	Paint	DFT (µm) Min.		
36	Supporting structure for ESP (#)	79-881	Blast Cleaning to Sa 2 ½ (Near white metal with Surface profile 35 – 50 µm)		<b>Primer:</b> Inorganic Ethyl Zinc Silicate primer (Solid by Volume min 60%). DFT = 75µm minimum				
37	Hopper approach platform (For items other than mentioned in s.no.33)	79-865							<b>Intermediate coat:</b> Polyamide cured Epoxy based pigmented TiO2 paint (volume solids min 60%). DFT = 75 µm minimum
38	Stringer for stairs case and guard plates, frames/Brackets for galleries, walkways & Staircases	89-610							

(#) For portion of steel surfaces embedded in concrete, the surface shall be prepared by power tool cleaning to ST3 and provided with primer coat of chlorinated rubber based zinc phosphate primer of Min. 50 micron DFT.

#### V Gates and dampers (Including Main and Aux. Boiler)

01	Gates and Dampers	Temperature > 95 ° C	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 Dampers	Temperature ≤ 95 ° C	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

SI No	Surface Location	PGMA	Surface Preparation	Primer		Finish		Total DFT in (μ m) Min.
				Paint	DFT (μm) min.	Paint	DFT (μm) Min.	

#### VI - Chimney for Aux. Boiler

01	Chimney shell, Ducts	Insulated side	87 100, 87 150	Power Tool Cleaning to St3 (SSPC-SP3)	Heat Resistant Aluminum Paint Gr 2 to IS 13183 (Two coats)	40	--	--	40
		Flue gas swept surfaces			Two coats of Red Oxide Zinc Phosphate Primer to IS: 12744(Two Coats)	50	--	--	50
02	Chimney Base, Painters Trolley (Other than SS) and Strakes		87 100, 87 200 87 150	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744(Two coats)	60	Synthetic Enamel to IS 2932 Grey shade 692 of IS 5 (Two Coats)	40	100
03	Platform, Ladder and hand rails		87 300	Hot Dip Galvanizing to 610 gm/Sq.M (min) and to a coated 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) PGMA's 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 . 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 PGMA's are to be painted. In case any component is left out, the same shall be deemed to be included under the relevant section

#### PAINING OF DAMAGED AREAS

(Areas where paint has deteriorated badly by erosion and areas where the paint film has lost its adhesion and where the steel has rusted appreciably, should be repainted as per following)

Paint damaged components falling under sl.No.36 to 38 of ESP	<b>Surface Preparation:</b> Power tool cleaning to bare metal	One coat of Epoxy Zinc rich primer to IS 14589 Gr II to DFT of 100 microns. Intermediate and finish: As given in respective scheme.
Paint damaged components falling under other serial Nos.	<b>Surface Preparation:</b> Power tool cleaning to bare metal	Primer and Finish: As given in respective scheme.

**PERFORMANCE TEST PROCEDURE OF GATES / DAMPERS  
( On FLOW)**

Rev.	Date	Description	Sign



EDC-DP,GATES & DAMPERS  
**BHARAT HEAVYELECTRICALS LIMITED**  
 Boiler Auxiliaries Plant  
 RANIPET – 632 406

Date	Prepared	Reviewed	Approved
01-02-2012	-sd- D.ASHWIN DHINAKAR	-sd- D.ASHWIN DHINAKAR	-sd- J.RAVISHANKAR

## 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

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 <sup>3</sup>
A	-	Connecting duct area of Cross section	m <sup>2</sup>
V	-	Velocity	m/sec
Q	-	Flow rate (leak rate)	m <sup>3</sup> / sec

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

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 <sup>3</sup> ) at test temperature and pressure.

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

$$Q = A \times V$$

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

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

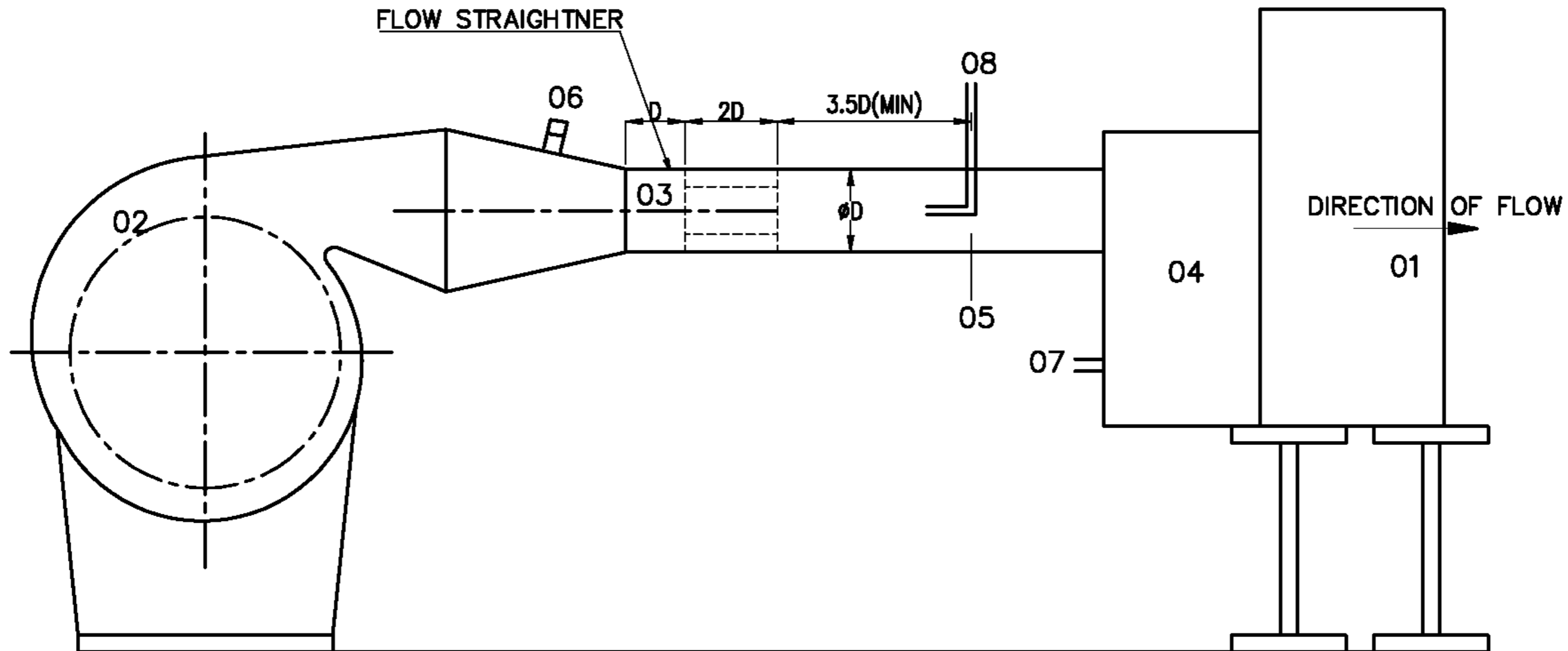
## Equipment List

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**

<b>LEAKAGE TEST OF GATE / BIPLANE DAMPER / FLAP DAMPER</b>						
<b>Project :</b>			<b>Size :</b>			
<b>WO No :</b>			<b>Test Date :</b>			
			<b>Time :</b>			
<b>Measured Values</b>	<b>Unit</b>	<b>Test 1</b>	<b>Test 2</b>	<b>Test 3</b>	<b>Test 4</b>	<b>Test 5</b>
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 <sup>2</sup>					
Seal air Pr	mmWC					
<b>Calculated Values</b>						
Volume flow thro' gate (MCR) Qs	m <sup>3</sup> /s					
Density (site), d1	kg/ m <sup>3</sup>					
Air density (test), d	kg/ m <sup>3</sup>					
Air velocity, V	m/s					
Volume leak (test), Q	m <sup>3</sup> /s					
% of leak tightness (test)	%					
Volume leak (site),Q1	m <sup>3</sup> /s					
% of leak tightness (site)	%					
<b>Tested by :</b>			<b>Witnessed by :</b>			

ALL DIMENSIONS ARE IN mm.



ITEM 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



**Bharat Heavy Electricals Ltd**  
 UNIT: BOILER AUXILIARIES PLANT  
 RANIPET - 632 406

DRAWN. S.D.G

APPD. MT

TITLE

**GATE**

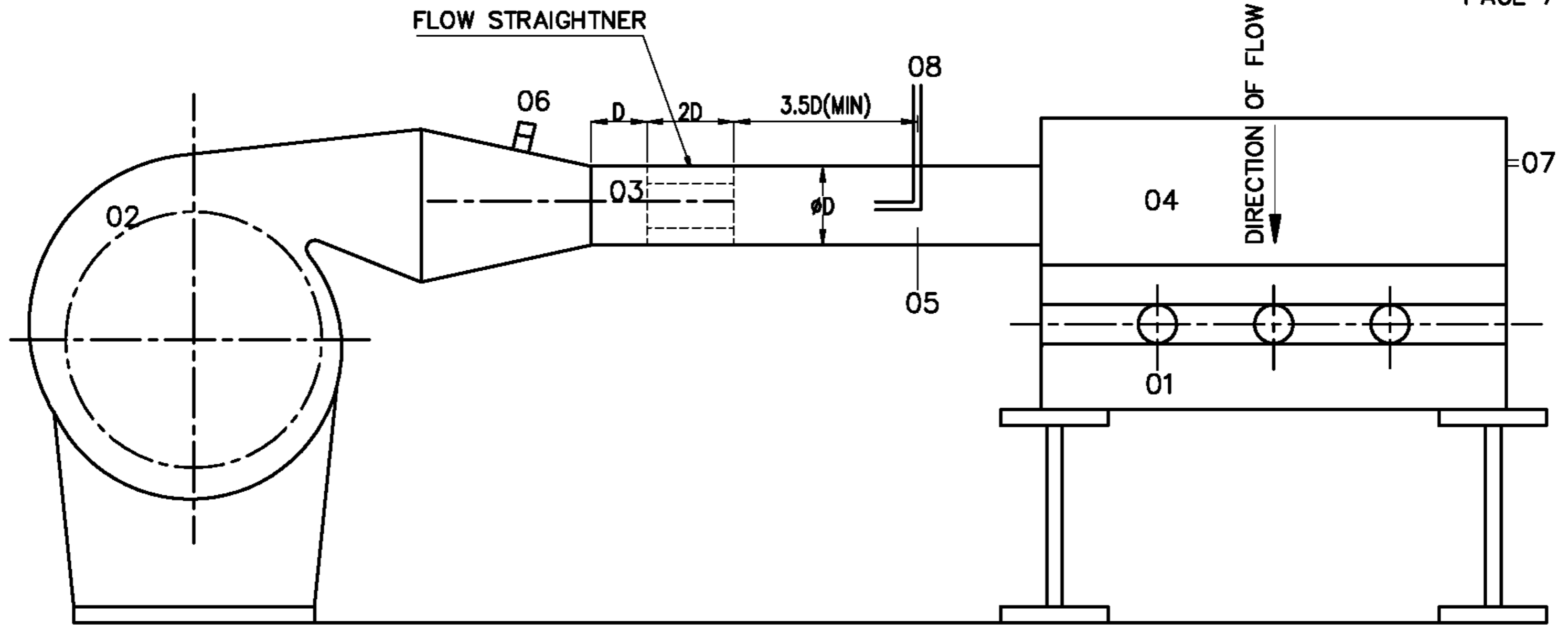
APPROVED

DATE  
21/01/08


DRG. NO.  
**ANNEXURE II**

REV  
00

ALL DIMENSIONS ARE IN mm.

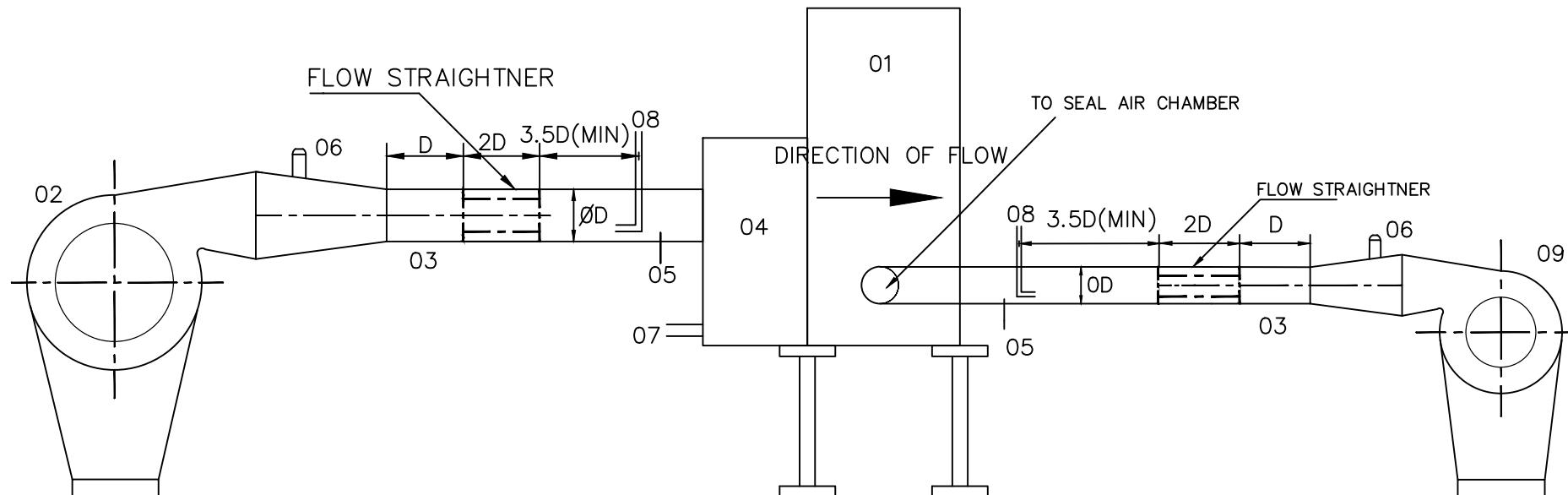


ITEM NO	ITEM NAME
01	DAMPER
02	PRESSURISING FAN
03	CONNECTING TRACK
04	PLENUM CHAMBER
05	THERMOMETER
06	BY PASS VALVE
07	PRESSURE TAP
08	PITOT TUBE


 <b>Bharat Heavy Electricals Ltd</b> UNIT: BOILER AUXILIARIES PLANT RANIPET - 632 406	<b>TITLE</b> BI-PLANE DAMPER		
	DRAWN. S.D.G APPD. MT	<b>APPROVED</b>	<b>DATE</b> 21/01/08

ALL DIMENSION ARE IN MM  
DRAWING NOT TO SCALE

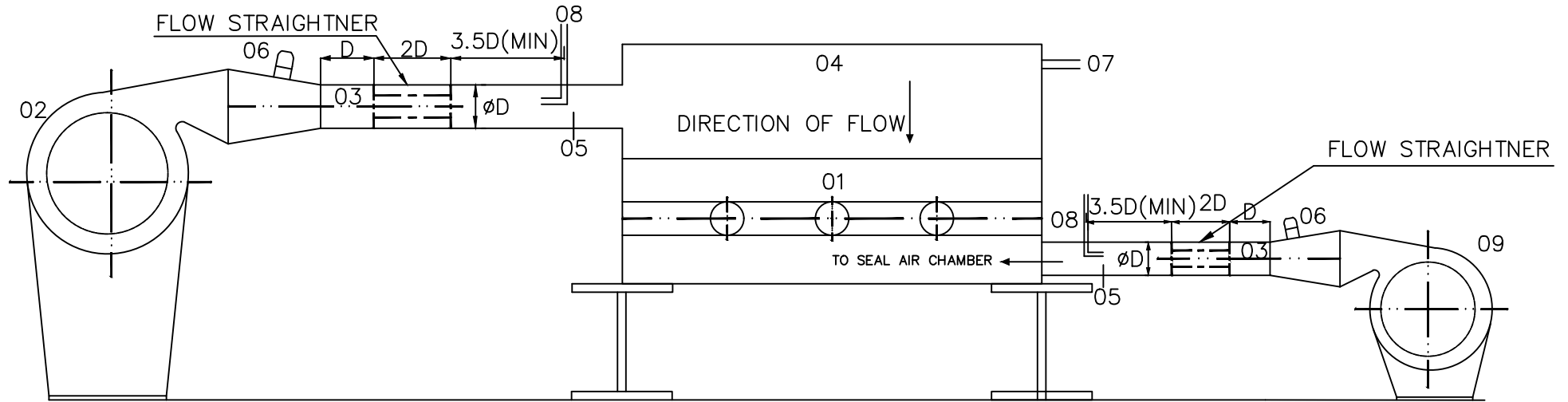
PAGE-8




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

		<b>Bharat Heavy Electricals Ltd</b> UNIT: BOLIER AUXILIARIES PLANT RANIPET - 632 406		<b>TITLE</b> TEST SETUP FOR GUILLOTINE GATE WITH SEAL AIR BLOWER	
DRAWN		APPROVED.		DATE	
A. NATARAJ		M. THAGAVEL		06.03.12	
				DRAWING NO :	
				ANNEXURE-IV	
				REV	
				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 <small>355-052</small>	TITLE: TEST SETUP FOR BI-PLANE DAMPER WITH SEAL AIR BLOWER			
	DRAWN A. NATARAJ	APPD M. THAGAVEL	DATE: 06.03.12	DRAWING NO : ANNEXTURE-V