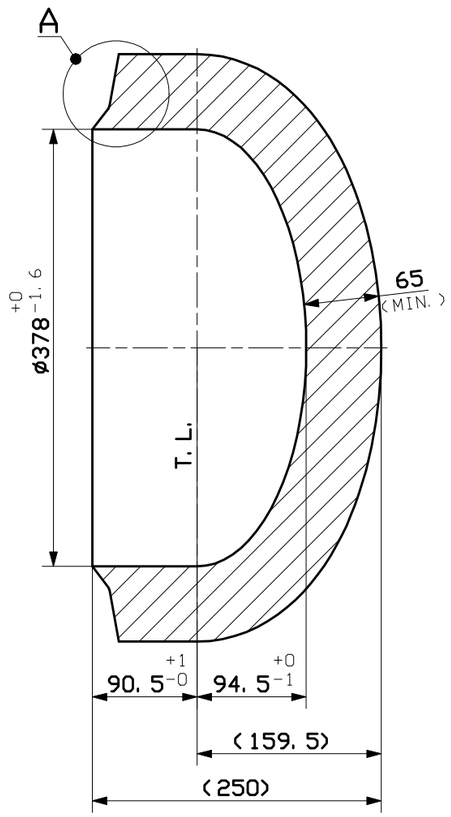
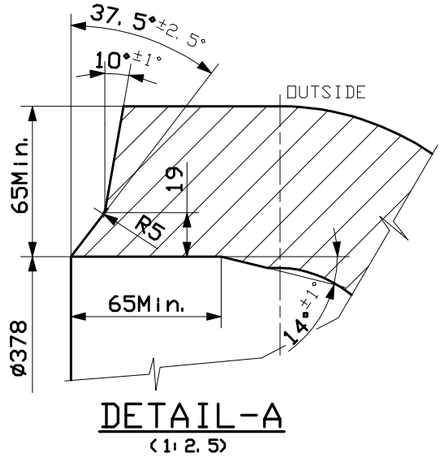
DRAWING NO: 3-93-420-05237

ALL DIMENSIONS ARE IN MILLIMETERS





DETAIL-A
(1:2.5)

NOTES:-

1. MATERIAL SPECIFICATION FOR THE FORGING IS SA350GRLF2 CLASS-1 WITH SUPPLEMENTARY REQUIREMENT ON CHEMICAL COMPOSITION AS GIVEN IN THE APPROVED SPECIFICATION.
2. DISHED END MATERIAL, MANUFACTURING, EXAMINATION AND PACKING SHALL BE IN ACCORDANCE WITH ASME SEC.III NB CL.1 AND AS PER APPROVED SPECIFICATION.
3. DISHED END SHALL BE SUPPLIED IN FINISH MACHINED CONDITION.
4. SURFACE FINISH SHALL BE RA 6.3 MICRONS ALL OVER.
5. DETAILED DRAWING INDICATING VARIOUS STAGES OF MANUFACTURE SHALL BE SUBMITTED FOR HIS APPROVAL.
6. WALL THICKNESS INDICATED ARE SPECIFIED IN MINIMUM VALUES.
7. TEST COUPONS REQUIREMENT SHALL BE MADE FROM SAME MELT AND HEAT TREATMENT BATCH AS SPECIFIED IN THE SPECIFICATION.
8. DISHED END AND WELD EDGES SHALL BE PROPERLY PROTECTED DURING TRANSPORTATION.
9. APPROXIMATE FINISHED WEIGHT : 171 KG

TOLERANCE IF NOT SPECIFIED SHALL BE AS BELOW (REFER IS 2102-m)

LINEAR				ANGULAR	
0.5 TO 3	±0.1	400 TO 1000	±0.8	0 TO 10	± 1°
3 TO 6	±0.1	1000 TO 2000	±1.2	10 TO 50	±30′
6 TO 30	±0.2	2000 TO 4000	±2.0	50 TO 120	±20′
30 TO 120	±0.3	—	-	120 TO 400	± 10′
120 TO 400	±0.5	—	-	OVER 400	± 5′

REV	DATE	ALTERED : CHD&APPD :	REV	DATE	ALTERED : CHD&APPD :

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: KAPP-3&4

Bharat Heavy Electricals Ltd
UNIT: HIGH PRESSURE BOILER PLANT
TIRUCHIRAPALLI - 620014
05-229/D

	NAME	SIGNATURE	DATE	NO. OF VAR
DRN	N.K		090810	
CHD	SOUGAT		100810	
APPD	V.R		100810	

DEPT	GRADE OF UNTOL. DIM	SCALE	WEIGHT (Kg)	REF TO ASSY / OLD DWG/CUSTOMER DWG.	ITEM NO	No OF ITEMS
NC	C/M/F	1:5 : 1:2.5		KAPP-3&4/33117/2001/DD		
CODE 150						

TITLE: ROH DISHED END
(2:1 ELLIPSOIDAL FORGING)

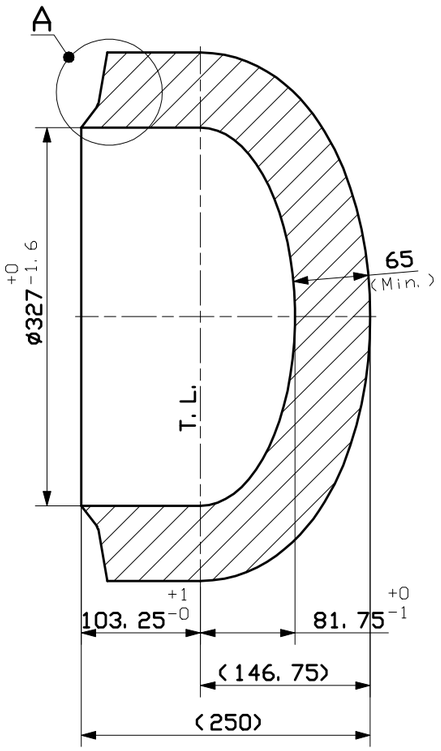
CARD CODE: U 01

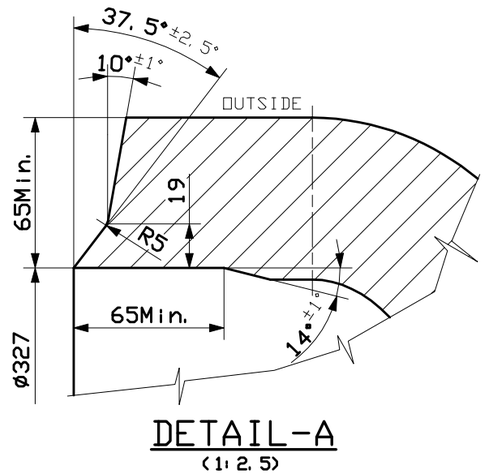
DRAWING NO : 3-93-420-05237 REV 00

Size A3

DRAWING NO: 3-93-420-05238

ALL DIMENSIONS ARE IN MILLIMETERS





DETAIL-A
(1:2.5)

NOTES:-

1. MATERIAL SPECIFICATION FOR THE FORGING IS SA350GRLF2 CLASS-1 WITH SUPPLEMENTARY REQUIREMENT ON CHEMICAL COMPOSITION AS GIVEN IN THE APPROVED SPECIFICATION.
2. DISHED END MATERIAL, MANUFACTURING, EXAMINATION AND PACKING SHALL BE IN ACCORDANCE WITH ASME SEC.III NB CL.1 AND AS PER APPROVED SPECIFICATION.
3. DISHED END SHALL BE SUPPLIED IN FINISH MACHINED CONDITION.
4. SURFACE FINISH SHALL BE RA 6.3 MICRONS ALL OVER.
5. DETAILED DRAWING INDICATING VARIOUS STAGES OF MANUFACTURE SHALL BE SUBMITTED FOR HIS APPROVAL.
6. WALL THICKNESS INDICATED ARE SPECIFIED IN MINIMUM VALUES.
7. TEST COUPONS REQUIREMENT SHALL BE MADE FROM SAME MELT AND HEAT TREATMENT BATCH AS SPECIFIED IN THE SPECIFICATION.
8. DISHED END AND WELD EDGES SHALL BE PROPERLY PROTECTED DURING TRANSPORTATION.
9. APPROXIMATE FINISHED WEIGHT : 148 KG

TOLERANCE IF NOT SPECIFIED SHALL BE AS BELOW (REFER IS 2102-m)

LINEAR				ANGULAR	
0.5 TO 3	±0.1	400 TO 1000	±0.8	0 TO 10	± 1°
3 TO 6	±0.1	1000 TO 2000	±1.2	10 TO 50	±30′
6 TO 30	±0.2	2000 TO 4000	±2.0	50 TO 120	±20′
30 TO 120	±0.3	—	-	120 TO 400	± 10′
120 TO 400	±0.5	—	-	OVER 400	± 5′

REV	DATE	ALTERED : CHD&APPD :	REV	DATE	ALTERED : CHD&APPD :

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: KAPP-3&4

Bharat Heavy Electricals Ltd
UNIT: HIGH PRESSURE BOILER PLANT
TIRUCHIRAPALLI - 620014
05-229/D

	NAME	SIGNATURE	DATE	NO. OF VAR
DRN	N.K		100810	
CHD	SOUGAT		110810	
APPD	V.R		110810	

DEPT	GRADE OF UNTOL. DIM	SCALE	WEIGHT (Kg)	REF TO ASSY / OLD DWG/CUSTOMER DWG.	ITEM NO	No OF ITEMS
NC	C/M/F	1:5 ; 1:2.5		KAPP-3&4/33117/2001/DD		
CODE 150						

TITLE: RIH DISHED END (2:1 ELLIPSOIDAL FORGING)

CARD CODE: U 01

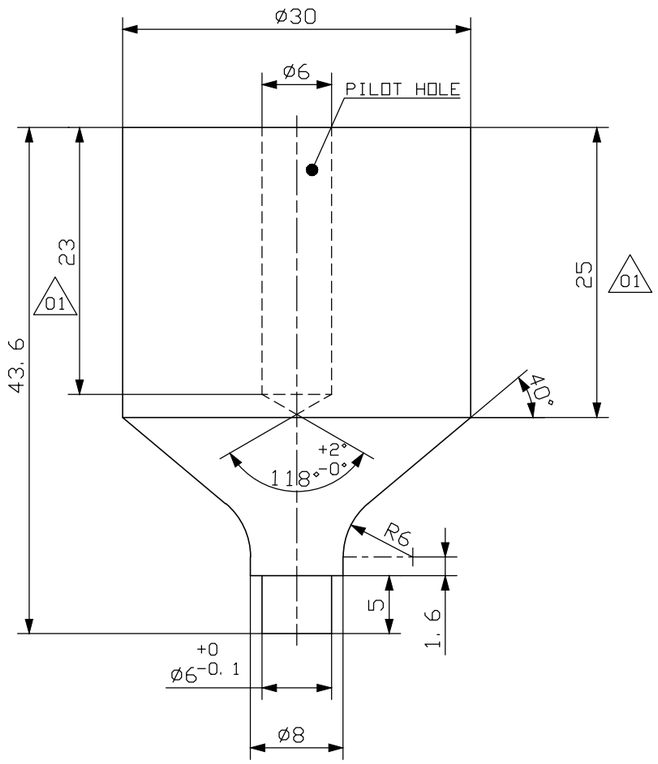
DRAWING NO : 3-93-420-05238

REV: 00

Size A3

DRAWING NO: 3-93-420-05243

ALL DIMENSIONS ARE IN MILLIMETERS



NOTES:-

1. MATERIAL SPECIFICATION FOR THE FORGING IS SA350GRLF2 CLASS-1 WITH SUPPLEMENTARY REQUIREMENT ON CHEMICAL COMPOSITION AS GIVEN IN THE APPROVED SPECIFICATION.
2. COMPONENT MATERIAL, MANUFACTURING, EXAMINATION AND PACKING SHALL BE IN ACCORDANCE WITH ASME SEC.III NB CL.1 AND AS PER APPROVED SPECIFICATION.
3. COMPONENT SHALL BE SUPPLIED IN FINISH MACHINED CONDITION.
4. SURFACE FINISH SHALL BE RA 6.3 MICRONS ALL OVER.
5. (01) DETAILED DRAWING INDICATING VARIOUS STAGES OF MANUFACTURE SHALL BE SUBMITTED FOR APPROVAL.
6. COMPONENT SHALL BE PROPERLY PROTECTED DURING TRANSPORTATION.
7. (01) APPROXIMATE FINISHED WEIGHT : 0.159 KG

TOLERANCE IF NOT SPECIFIED SHALL BE AS BELOW (REFER IS 2102-m)

LINEAR				ANGULAR	
0.5 TO 3	±0.1	400 TO 1000	±0.8	0 TO 10	± 1°
3 TO 6	±0.1	1000 TO 2000	±1.2	10 TO 50	±30′
6 TO 30	±0.2	2000 TO 4000	±2.0	50 TO 120	±20′
30 TO 120	±0.3	—	-	120 TO 400	± 10′
120 TO 400	±0.5	—	-	OVER 400	± 5′

REV	DATE	ALTERED : / CHD&APPD :
01	111210	ALTERED : / CHD&APPD : fwl.

DIMN. 25 ADDED, DIMN. 23 WAS 10 AND NOTE-5&7 CORRECTED AS PER CUSTOMER LETTER KAPP-3&4/RAPP-7&8/33111/NP/2010/M/402 DATED 07.12.2010.

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: KAPP-3&4

Bharat Heavy Electricals Ltd
UNIT: HIGH PRESSURE BOILER PLANT
TIRUCHIRAPALLI - 620014
05-229/D

	NAME	SIGNATURE	DATE	NO. OF VAR
DRN	N.K		160810	
CHD	SOUGAT	fwl.	170810	
APPD	V.R		170810	

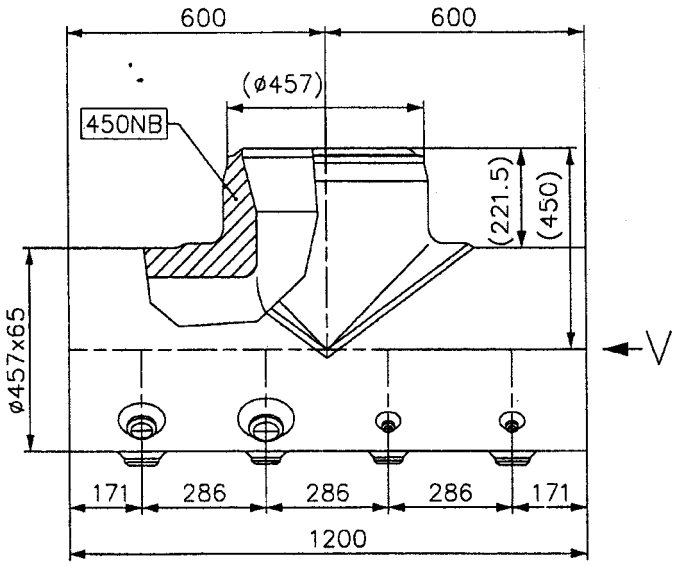
DEPT	GRADE OF UNTOL. DIM	SCALE	WEIGHT (Kg)	REF TO ASSY / OLD DWG/CUSTOMER DWG.	ITEM NO	No OF ITEMS
NC	C/M/F	2:1		KAPP-3&4/33117/2006/DD		
CODE 150						

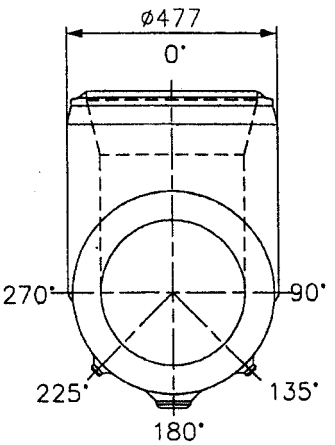
TITLE: 3/8" NB INSTRUMENTATION NOZZLE

CARD CODE: U 01

DRAWING NO : 3-93-420-05243 REV 01

Size A3

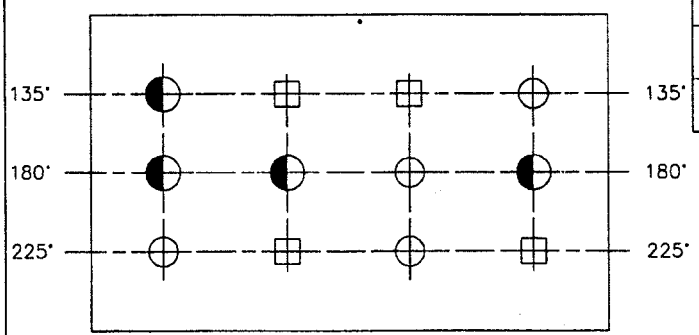




VIEW–V

NOZZLE LEGEND & QUANTITY

SYMBOL	NOZZLE DESCRIPTION	QTY
	FEEDER PIPE NOZZLE 65NB	4
	FEEDER PIPE NOZZLE 50NB	4
	INSTRUMENTATION NOZZLE 20NB	4



FEEDER PIPE NOZZLES
DEVELOPED PLAN

MATL.SPECN. : SA350 LF2 CL.–1
QUANTITY : 1 No.

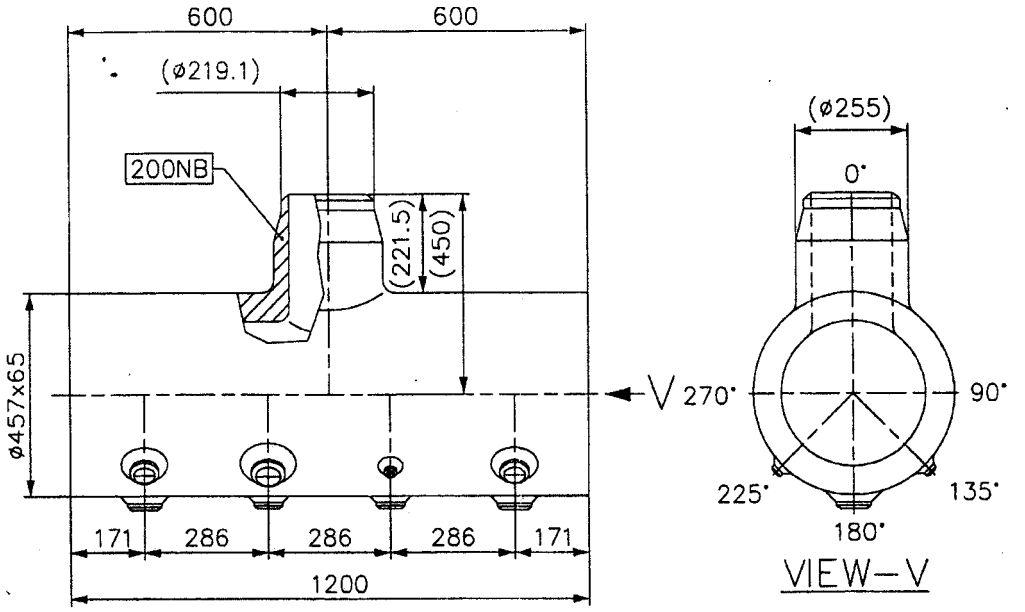
NOTES: –

1. FOR ALL OTHER DETAILS, (SECTIONAL DIMENSION, TOLERANCE, SURFACE FINISH...) REFER ANY ONE OF THE INLET HEADER FORGING DRG. AND FOR MACHINING, EXAMINATION, SECTIONING OF NOZZLE SHALL BE AS PER CLAUSE NO. 9.3 OF TDC D139–TDC–001 (LATEST REV)

2. THE SECTIONED NOZZLES AND BALANCE MATERIAL SHALL BE DESPATCHED ALONG WITH MAIN HEADER WITH PROPER IDENTIFICATION.

DRN	KR	TITLE: SAMPLE FORGING WITH 450NB NOZ (RIH–700MWe)	SK. NO. SK:4:D139:001	REV 00
CHD	MANDAL			
APPD	VR			
DATE	231210			

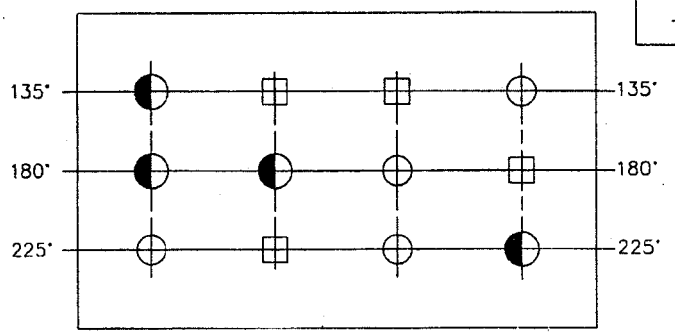
Size A4



VIEW–V

NOZZLE LEGEND & QUANTITY

SYMBOL	NOZZLE DESCRIPTION	QTY
	FEEDER PIPE NOZZLE 65NB	4
	FEEDER PIPE NOZZLE 50NB	4
	INSTRUMENTATION NOZZLE 20NB	4



FEEDER PIPE NOZZLES
DEVELOPED PLAN

MATL.SPECN. : SA350 LF2 CL–1
QUANTITY : 1 No.

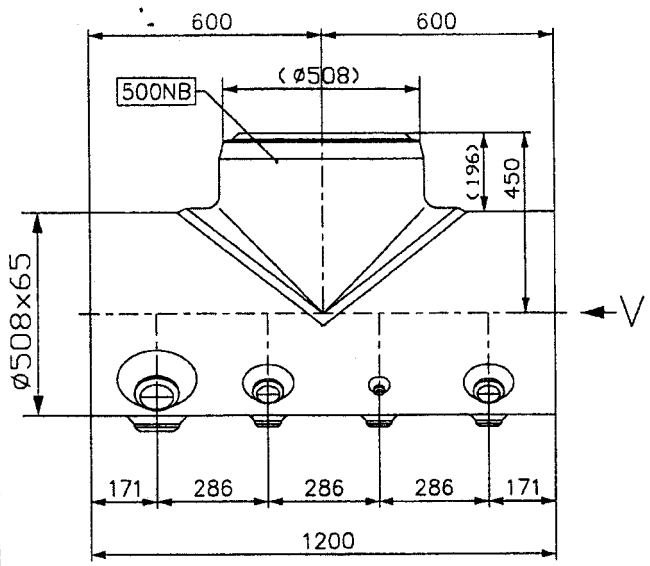
NOTES: –

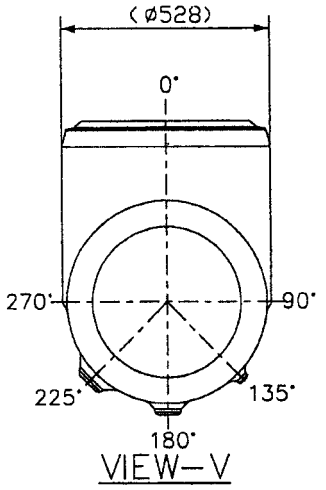
1. FOR ALL OTHER DETAILS, (SECTIONAL DIMENSION, TOLERANCE, SURFACE FINISH...) REFER ANY ONE OF THE INLET HEADER FORGING DRG. AND FOR MACHINING, EXAMINATION, SECTIONING OF NOZZLE SHALL BE AS PER CLAUSE NO. 9.3 OF TDC D139–TDC–001 (LATEST REV)

2. THE SECTIONED NOZZLES AND BALANCE MATERIAL SHALL BE DESPATCHED ALONG WITH MAIN HEADER WITH PROPER IDENTIFICATION.

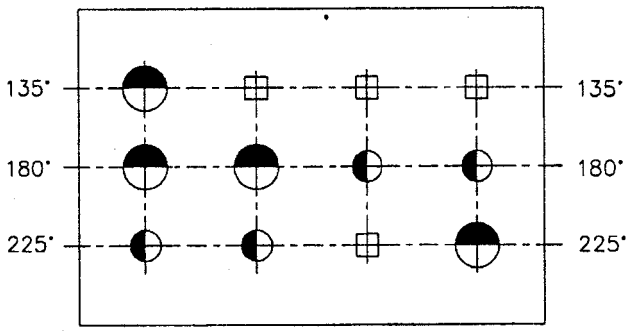
DRN	KR	TITLE: SAMPLE FORGING WITH 200NB NOZ (RIH–700MWe)	SK. NO. SK:4:D139:002	REV 00
CHD	MANDAL			
APPD	VR			
DATE	231210			

Size A4





VIEW–V



FEEDER PIPE NOZZLES
DEVELOPED PLAN

NOZZLE LEGEND & QUANTITY

SYMBOL	NOZZLE DESCRIPTION	QTY
	FEEDER PIPE NOZZLE 100NB	4
	FEEDER PIPE NOZZLE 65NB	4
	INSTRUMENTATION NOZZLE 20NB	4

MATL.SPECN. : SA350GRLF2
QUANTITY : 1 No.

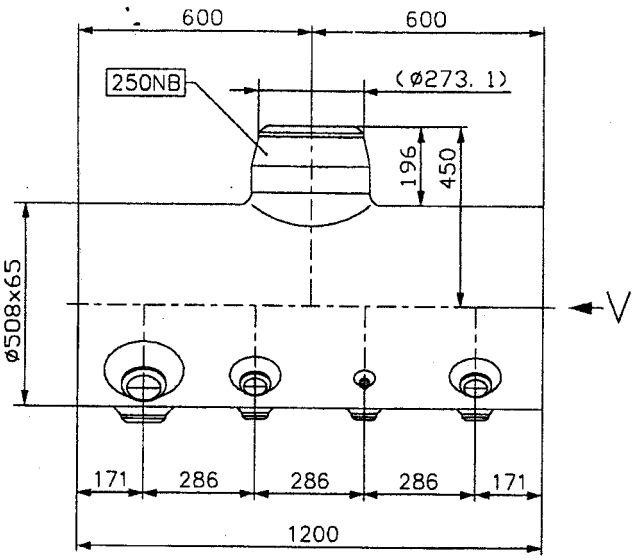
NOTES: –

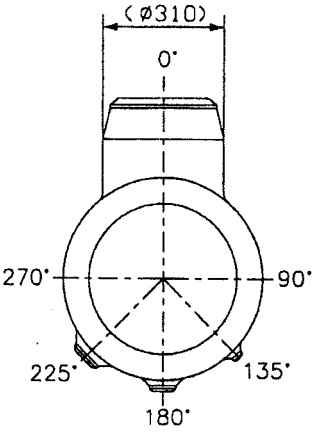
1. FOR ALL OTHER DETAILS, (SECTIONAL DIMENSION, TOLERANCE, SURFACE FINISH...) REFER ANY ONE OF THE OUTLET HEADER FORGING DRG. AND FOR MACHINING, EXAMINATION, SECTIONING OF NOZZLE SHALL BE AS PER CLAUSE NO. 9.3 OF TDC D139–TDC–001 (LATEST REV)

2. THE SECTIONED NOZZLES AND BALANCE MATERIAL SHALL BE DESPATCHED ALONG WITH MAIN HEADER WITH PROPER IDENTIFICATION.

		TITLE:	SK. NO.	REV
DRN	E.B	SAMPLE FORGING WITH 500NB NOZ (ROH–700MWe)	SK–4–D139–003	00
CHD	MANDAL			
APPD	V.R			
DATE	23.12.2010			

Size A4

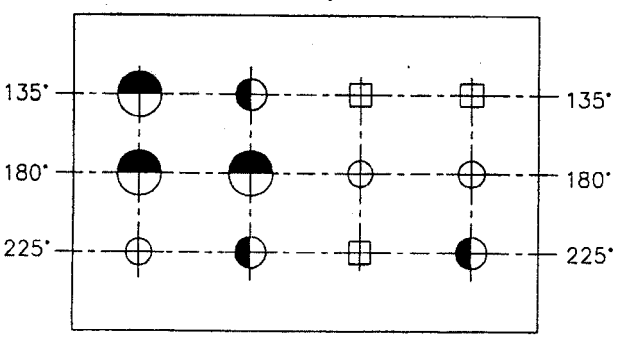




VIEW–V

NOZZLE LEGEND & QUANTITY

SYMBOL	NOZZLE DESCRIPTION	QTY
	FEEDER PIPE NOZZLE 100NB	4
	FEEDER PIPE NOZZLE 65NB	4
	INSTRUMENTATION NOZZLE 20NB	4



FEEDER PIPE NOZZLES
DEVELOPED PLAN

MATL.SPECN. : SA350 LF2 CL.–1
QUANTITY : 1 No.

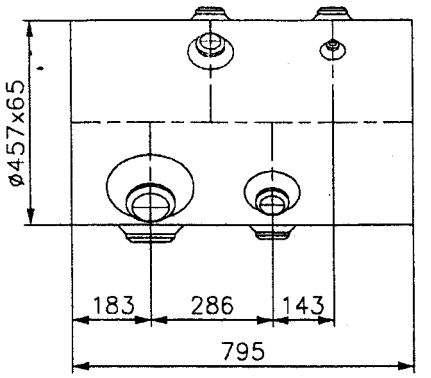
NOTES: –

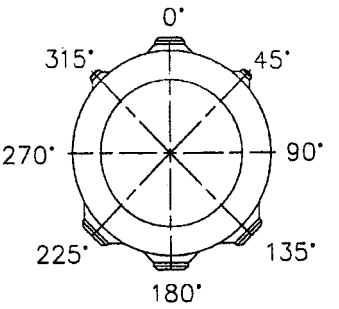
1. FOR ALL OTHER DETAILS, (SECTIONAL DIMENSION, TOLERANCE, SURFACE FINISH...) REFER ANY ONE OF THE OUTLET HEADER FORGING DRG. AND FOR MACHINING, EXAMINATION, SECTIONING OF NOZZLE SHALL BE AS PER CLAUSE NO. 9.3 OF TDC D139–TDC–001 (LATEST REV)

2. THE SECTIONED NOZZLES AND BALANCE MATERIAL SHALL BE DESPATCHED ALONG WITH MAIN HEADER WITH PROPER IDENTIFICATION.

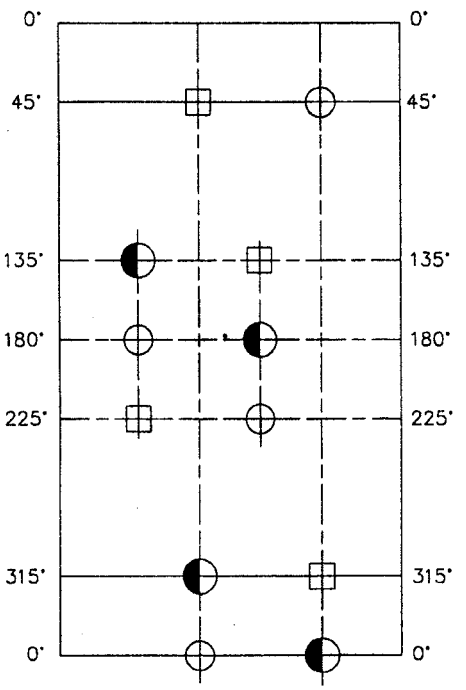
DRN	E.B	TITLE: SAMPLE FORGING WITH 250NB NOZ (ROH–700MWe)	SK. NO. SK–4–D139–004	REV 00
CHD	MANDAL			
APPD	V.R			
DATE	23.12.2010			

Size A4





VIEW–V



NOZZLE LEGEND & QUANTITY

SYMBOL	NOZZLE DESCRIPTION	QTY
	FEEDER PIPE NOZZLE 65NB	4
	FEEDER PIPE NOZZLE 50NB	4
	INSTRUMENTATION NOZZLE 20NB	4

FEEDER PIPE NOZZLES DEVELOPED PLAN

MATL.SPECN. : SA350 LF2 CL.–1
QUANTITY : 1 No.

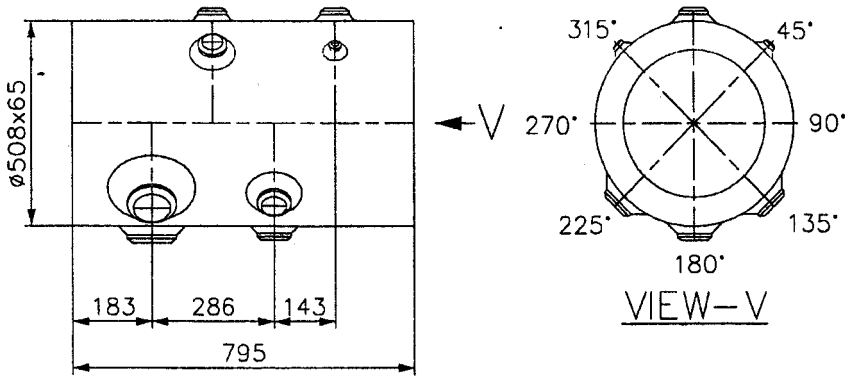
NOTES: –

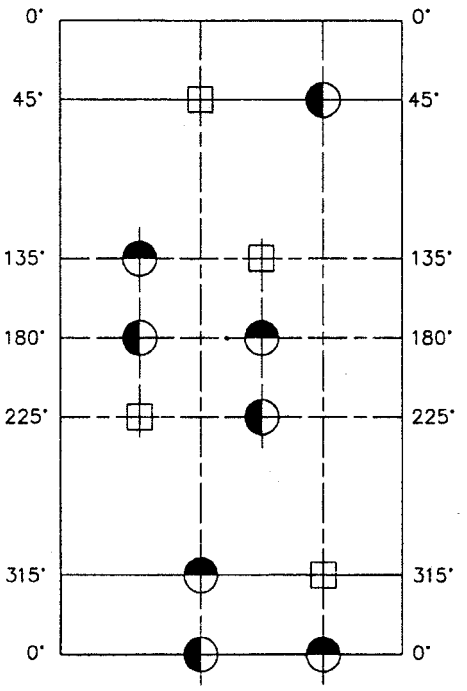
1. FOR ALL OTHER DETAILS, (DIMENSION, TOLERANCE, SURFACE FINISH...) REFER ANY ONE OF THE INLET HEADER FORGING DRG. AND FOR MACHINING, EXAMINATION OF NOZZLE SHALL BE AS PER CLAUSE NO. 9.3 OF TDC D139–TDC–001 (LATEST REV)

2. THE SAMPLE FORGING SHALL BE DESPATCHED ALONG WITH MAIN HEADER WITH PROPER IDENTIFICATION.

DRN	KR	TITLE:	SK. NO.	REV
CHD	MANDAL	SAMPLE FORGING WITH FEEDER NOZ (R.I.H.–700MWe)	SK:4:D139:005	00
APPD	VR			
DATE	241210			

Size A4





FEEDER PIPE NOZZLES
DEVELOPED PLAN

NOZZLE LEGEND & QUANTITY

SYMBOL	NOZZLE DESCRIPTION	QTY
	FEEDER PIPE NOZZLE 100NB	4
	FEEDER PIPE NOZZLE 65NB	4
	INSTRUMENTATION NOZZLE 20NB	4

MATL.SPECN. : SA350 LF2 CL.–1
QUANTITY : 1 No.

NOTES: –

1. FOR ALL OTHER DETAILS, (DIMENSION, TOLERANCE, SURFACE FINISH...) REFER ANY ONE OF THE OUTLET HEADER FORGING DRG. AND FOR MACHINING, EXAMINATION OF NOZZLE SHALL BE AS PER CLAUSE NO. 9.3 OF TDC D139–TDC–001 (LATEST REV)

2. THE SAMPLE FORGING SHALL BE DESPATCHED ALONG WITH MAIN HEADER WITH PROPER IDENTIFICATION.

DRN	E.B	TITLE: SAMPLE FORGING WITH FEEDER NOZ (R.O.H.–700MWe)	SK. NO. SK:4:D139:006	REV 00
CHD	MANDAL			
APPD	VR			
DATE	241210			

Size A4

Revision Record: Rev- 01: Revised with Customer comments
Rev-02: Revised with Customer comments

Table of Contents

Prepared by (BHEL)	Reviewed & Approved by (BHEL)	Approved by (NPCIL)
(K.Krishnamoorthi)	(M.Ponnusamy)	

1.0 Scope

1.1 This specification prescribes the additional requirements for SA350LF2 Cl.1 forgings conforming to ASME code section III, NB, Cl.1, 2010 Edition.

2.0 Applicable Documents

2.1 ASME Boiler & Pressure Vessel Code (2010 Edition)

(1) Section II, Part A, SA 350 LF2
(2) Section III, Subsection NB (Hereinafter referred to as NB)

3.0 Requirements

3.1 The material shall conform to the requirements of SA350LF2 Cl.1 material specification / and the requirements added by this specification.

4.0 Documents to be Submitted (along with Bid & Prior to Start of Manufacture)

4.1 Along with Bid: Quality Assurance program, Proposed manufacturing and test plan, Chemical analysis procedure with expected level of trace elements,Heat treatment(HT) plan,applicable test procedures and Packing procedure

4.2 Prior to Start of Manufacture: (For approval): Forging Drawings, Stage wise Forging plan showing discard of ingot, reduction at each stage, orientation of forging with respect to Ingot and rough forged shape including protrusions if any, UT stage drawings ,HT plan including Simulation HT.,Material Sampling and Test plan (with sketches for specimen location) including hardness survey on the product and associated test coupons, Stage wise inspection plan including NDE., Cleaning, preservation and packing procedure with particulars of shipping dimension,weight lifting locations and all NDE,Macro ,etch & test procedures.

5.0 Quantity and Nominal Size

5.1 The Quantity and nominal size of Forgings shall be indicated in the applicable drawing referred in Enquiry / Purchase Order (PO).

6.0 Material Specification

6.1 SA 350 LF 2 , Cl.-1

7.0 Type and Dimension

7.1 The fine grained forgings (Dished Ends and Header Forgings)shall be Seamless single piece. Header forgings shall be single piece construction with all Nozzles (Large & Small) integral.The forgings shall be supplied in Normalised condition.

7.2 Dimensions shall be in accordance with applicable drg. referred in Enquiry / PO.

8.0 Repair by Welding

8.1 Repair by welding shall not be permitted.

8.2 Surface defects can be removed by mechanical means with the approval of BHEL and the defective areas shall be smoothly dressed up with the adjacent surface. The minimum thickness after repair shall meet the drawing / Specification requirements. Purchaser reserves all rights to accept or reject the forgings based on the extent of repair called for.

9.0 Manufacture

The steel shall be made by the open-hearth, basic –oxygen, or electric-furnace fully killed and fine grained steel shall be Vacuum degased followed by electroslag remelting.

9.1 The material shall be forged as close as practicable to the specified shape and size and the forging ratio shall be 4 or more.Single piece headers with all the large and small integral nozzles shall be manufactured by forging and machining**.**

9.2 The forgings shall be properly machined for the required shape and size as per the drawing.

9.3 Header Nozzles - General

The nozzles in the header shall be formed by machining the projected portion/thick wall of the forged shell. The end dimensions of thus formed nozzles shall match the dimensions as per drawings. The supplier shall qualify his manufacturing procedures to the satisfaction of the purchaser, by production of samples as per enclosed sketches. These nozzles shall be made from the same materials and by the same techniques as of the forgings of this specification.

All samples and production nozzles shall be examined by ultrasonic and magnetic particle methods. Examination procedures shall satisfy the requirements as specified in this specification. Ultrasonic examination and Magnetic Particle examination shall be conducted and accepted in accordance with the requirements of NB- 2500.

Mock up sample nozzles (each size) as per enclosed sketches SK:4:D139: 001 to 004 all rev 00 shall be sectioned each(in two planes through the nozzle centre-line (through and at right angles to the header centre-line), following the specified non- destructive examinations. The sections shall conform to the requirements of respective drawings. One sectioned surface from each quadrant shall be polished, etched and inspected. The material shall be free from cracks, tears, injurious inclusions, laminations and other defects. The second mock up sample machined nozzle as per sketch SK: 4: D139: 005&006 all rev 00 shall be allocated for preparation of the nozzle weld qualification coupon.

9.4 All the mock up sample nozzles including the cut sections, shall be supplied along with the header forgings for purchaser's use .

10.0 Chemical Requirements

The steel shall conform to the requirements specified in the following, determined by heat analysis and Product analysis.

Composition wt %

Carbon	0.30 max	Chromium	0.25 max
Cobalt	0.02 max	Copper	0.30 max
Sulphur	0.025 max	Nickel	0.40 max
Phosphorus	0.025 max	Molybdenum	0.10 max
Aluminium	0.04 max	Manganese	0.6 - 1.35
Vanadium	0.01 max	Silicon	0.15 – 0.30

Additional elements Sn=0.011max, N=0.013max, As=0.025max, Sb=0.007max.

11.0 Mechanical Requirements

11.1 Extent of test: Each size/heat/HT batch from product sample or identical test coupon

11.2 Tests Coupons from which Mechanical,Impact and other tests specimens are to be machined shall be subjected to Simulated Heat Treatment at 600±10 ºC for 6 Hrs.

11.3 All specified mechanical, metalographic chemical analysis tests shall be conducted on specimens taken from both ends, mid length region and large nozzle cores of each header.The specified min test values as per the spcification shall be applicable and complied by specimens of all orientations; longitudinal, transverse and normal.

11.4 The material shall conform to the mechanical property requirements prescribed in SA 350 LF 2 , Cl.-1. The specimen test method shall be accordance with SA-370.

11.5 Determine T_{NDT} by drop weight test/ ASTM E208 / Specimen Type P.No.2. and conduct Charpy V-Notch Test (Cv) in accordance with NB2320 / SA-370 at a temperature T_{NDT}+33ºC and meet the requirements NB-2330. R_{TNDT} shall not be more than -15 ºC. Location and orientation of Test specimens shall be as per NB 2322.Drop weight confirmatory tests shall show two no- breaks at -15°C.

11.6 Other tests:

1. Micro Structure evaluation
2. Hardness Test both on the face and along the length (≤197 HB)
3. FATT- (Fracture Apperance at transition
5. Fatique as per ASTM E1820 both radial & tangential specimens.

Temperature)Impact test shall be conducted on radial specimens at atleast 7 temperatures(-45°,-15°,0°,+18°,-,-,-°C) and transition curves(for absorbed energy, lateral expansion, %shear fracture) covering lower and upper shelves shall be drawn for each melt and heat treatment batch.

4. Additional Fracture Toughness at 18 ºC (Transverse / normal specimen to obtain 68J and 0.9mm of obsorbed energy and Lateral expansion respectively)
6. Bend test - bending at 180º /Mandrel 1 in. (25.4mm)
7. Grain size (5 or finer)
8. Inclusion rating evaluation
9. NDT verification on samples from other Forgings - No Break at -15 ºC.

11.7 Additional mechanical tests(Impact and Drop weight test) on specimens parallel to the Nozzle axis from nozzle protrusions of larger nozzles shall be carried out to confirm achievement of the specified mechanical properties of the Forging material.

11.8 Measurement of residual stresses

12.0 Non Destructive Examination

12.1 Ultrasonic Examination shall be performed over the entire volume of forging material by normal and angle beam examination in two opposite axial and two opposite circumferential direction and also from header ends with acceptance standard based upon the final thickness of the nozzles in accordance with NB 2500.

12.2 Magnetic particle examination or Liquid penetrant examination shall be performed on all external surfaces and all accessible internal surfaces in accordance with NB-2545 or NB 2546 as applicable.

12.3 The time of non-destructive examination shall be based on NB-2557.

12.4 All nondestructive examination personnel performing the required examination shall be qualified in accordance with ASME Section III NB-5520

12.5 Additional NDE on Nozzle over the entire surface by normal and angle beam examination in two opposite axial and two opposite circumferential direction and also from nozzle top face before machining to final shape shall be carried out for soundness by volumetric and Surface examination. Acceptance standard shall be based on final nozzle thickness.

13.0 Cleanliness

13.1 The finished header shall be clean and free from millscale, rust and foreign material

13.2 All internal surfaces of the header shall be clean to bright metal and free from oxides, embedded, adherent or loose contaminants

14.0 Marking

Each forgings shall be legibly marked in accordance with NB-2150 and ASME Section II, Part A, SA 350 LF 2 Cl.-1 by the material supplier to assure identification of each forging with its Test Certificate and shall contain the below listed items as a minimum.

(1) Material manufacturer's name or trademark.
(2) Material specification number.
(3) size
(4) Heat number and Heat treated condition.
(5) Header identification number.
Identification by metal stamping is not permitted.

15.0 Right to Access

Purchaser and his authorised inspector shall be given free access, at all time while work on the contract is being performrd, to all parts of manufacturer,s factory that concerns the manufacture of the material orderd.

16.0 Submittal Documents with Material

16.1 The supplier shall submit all recorded documents as in Clause 4.0 and any other report / procedure called for.

17.0 Witness and Hold Point

The test and examination shall be carried out in the presence of the Inspecting Agency authorised by BHEL, wherever specified in the inspection and test plans to be submitted for approval. Each item shall be backed by 5 copies of test certificate furnishing the following details legibly in English language only, duely certified by the inspecting authority:

1. Purchase Order No.(BHEL),TDC No. & Test certificate number
2. Specification and Grade with applicable year of code, Steel making process
3. Quantity & Size, Drg number, Heat Number
4. Chemistry including incidental elements - Ladle and Product analysis.
5. Heat treatment details of the material and test coupons including actual HT charts.
6. Mechanical test results, NDE test results with reference & acceptance standard.
7. Cleaning & Surface treatment details, Dimensional reports.

ANNEXURE-I - Special conditions for Manufacture and supply of Reactor headers and dished ends:

1. All the above Header and Dished forgings shall be as per relevant drawings, ASME specification SA350LF2 CL1, Technical delivery condition No D139-TDC-001 Rev:02

2. Supplier shall submit detailed manufacturing process and inspection plan planned to manufacture the reactor headers and dished ends. The process shall include the steel melting process, forging process, and machining of headers and dished ends.

3. **Header manufacturing guideline:** Reactor inlet and outlet header wall thickness less than 65.0mm at any point shall be the cause for rejection of such forged shells. However around the integral nozzle openings the wall thickness shall be increased to meet the reinforcement requirements. These large nozzle opening reinforcement and transition shape details given in the drawing shall be met without any deviation. When small integral nozzles for feeders and instrumentation are contoured over the OD by machining operation from a thicker hollow forging, additional tests on radial specimens and additional NDE on the nozzle protrusion shall be carried out to confirm achievement of the specified mechanical properties for the header material along the nozzle axis also and to ensure the required soundness in the integral nozzle protrusions as shown in the drawings.

4. Test coupons requirements shall be estimated separately and indicate all the sizes/sketches and specimen locations in their offer separately. The respective test coupons shall be made from same melt of the corresponding component. Offers do not contain above details shall not be considered for technical evaluation.

5. **UT examination in addition to TDC point 12.0 :** Ultrasonic examination shall be performed in accordance with the requirements of NB-2500 of Section III of ASME Code using procedures and standards such as to ensure consistent detection and discrimination of transverse and longitudinal defects. The reference standards shall be made from material of the same composition, diameter, thickness and surface condition and heat treatment conditions as of the material which is to be examined. The width, shape and method of producing the notches may be altered, without sacrificing the defect detection sensitivity, subject to Purchaser's approval. All ultrasonic defect indications shall be investigated to determine the defect characteristics such as size, shape, location and orientation. The basis of acceptance or rejection of components shall be as following: The reference level for straight beam examination shall be 4 mm diameter flat bottomed hole for thickness (t) > 200 mm, 3 mm for t ≤200 mm and + > 100 mm and 2 mm for t $\leq$ 100 mm and for angle beam examination it shall be a notch 3mm wide x 12 mm long x 0.03 t (3 mm max.) deep. Examination of forging must be performed from both thickness faces and from the cylindrical surface with normal beam probes. Additional scanning in the circumferential direction with 35 deg. angle beam probes shall be carried out for forgings. The acceptance standard shall be based on defect standard of CRR (Circular Reference Reflector) dia 1.2mm and notch (U-type notch) dimensions of 1.6 mm max width 2.5mm depth, whichever is stringent and for nozzles dia 0.5mm for normal beam. Since UT examination not feasible after final machining due to the geometry of the finished headers, hence the UT examination shall be carried out in stages. First examination shall be after heat treatment and rough machining. And the second stage examination after first machining of nozzles in cylindrical shapes.

6. Acceptance Criteria: Products shall not be acceptable if indications of echoes are higher than DAC (or reference level) when UT inspected in straight or angle beam. The results obtained during the ultrasonic examination carried out by supplier form the base line/reference data for future in service inspections to be conducted by the Purchaser. Hence, characteristics of all recordable defect indications within acceptance limits as well as description of ultrasonic procedure and equipment etc. shall be documented in detail such that any of those recordable defect indications could be identified and reproduced at a later date and during the service life of header assemblies, any changes in characteristics of those defect

indications could be monitored and compared with respect to the base line/reference data. The documentation shall include sketches or maps showing the recordable defect sites with respect to well defined reference points on the Header Assemblies.

7. Cleaning and surface treatment procedure shall be submitted to purchaser for approval. All chemicals and fluids such as cleaning agents, penetrants, developers and water used for hydrostatic testing and paints used for marking shall preferably be free from halogen and sulphur. However, in no case more than 25 ppm of halogen and sulphur shall be permitted. Examination materials, chemicals, fluids, or any other material used for examination, inspection and tests shall be removed from the product to achieve a clean-dry surface.

8. In addition to the examination, inspection and tests mentioned in TDC and special conditions, the finish of all surfaces of component shall be inspected visually as required by the basic SA - Material Specifications. This shall include the use of boroscope, dental, mirrors or any other devices where necessary.

9. The Purchaser or his authorized agency shall have access to the Manufacturer's or their sub-contractor's premises at all reasonable times and to the extent necessary to assess compliance with the provisions of the said programme and this specification. Examination, inspection and test reports shall be submitted by the Manufacturer to Purchaser.

10. The above forgings are required for 700MWe Nuclear Power plant for KAPP 3&4 & RAPP-7&8 and "**End Use Certificate**" will not be given.

11. Six sets of additional dialets containing Test Certificate, copies of the approved procedures DCR, Drawings etc .. apart from contractual requirements are required.

12. Supplier should have experience in handling of similar forgings and production of ESR material, also the supplier has to furnish the test certificate for the similar major components.

13. Offers from suppliers sourcing materials from China / supplies from China are not acceptable. Offers from Traders are not acceptable.

14. The supplier shall confirm clause by clause confirmation on the TDC, special conditions and drawing notes along with their offer. Some of the points mentioned in this section, Drawing notes and TDC may be repeated. Offers not confirming the clauses will not be considered for technical evaluation.

15. Sample quality plan is enclosed; the supplier shall consider and submit the quality plan in line with the sample plan along with technical offer by incorporating the appropriate manufacturing activity.

16. Inspection: aa. For Foreign Suppliers: by any of the three approved third parties viz.,
i) TUV Nord(North) ii) BV and iii) SGS
bb. For Indian Suppliers: by BHEL and Customer (NPCIL)

17. Notes given in the respective drawings shall be read and confirmed.

ANNEXURE-I - Special conditions for Manufacture and supply of Reactor headers and dished ends:

SAMPLE QUALITY PLAN

SL NO	OPEARATION	TPI		
		A	B	C
01	Steel melting process and ladle analysis	✓		✓
02	Identification of ingot	✓		✓
03	Forging process	✓	✓	
04	Heat analysis	✓	✓	
05	Rough machining and UT examination	✓		✓
06	Heat treatment	✓	✓	
07	Removal of samples from header	✓		✓
08	Proof machining of header	✓	✓	
09	UT examination on the proof machined header	✓		✓
10	Test material identification	✓		✓
11	Sample material cutting	✓	✓	
12	Product analysis	✓		✓
13	Grain size & structure	✓		✓
14	Simulation HT	✓	✓	
15	Mechanical Test	✓		✓
16	Final machining	✓	✓	
17	Dimensional inspection	✓		✓
18	Proof test	✓		✓
19	Visual inspection	✓	✓	
20	Document/Test certificate verification	✓		✓
21	Preservation and packing	✓		✓
22	TPI certificate	✓		✓
23	Shipping release	✓		✓
24	Establishing the sample forging procedure, machining and examination	✓		✓
25	Include stages of sample forging as indicated Sl no:01 to 23	✓		✓

Legend:
A=Checking test report
B=Checking of material
C=Witnessing of operation

NOTE:

1.) The above stages are indicative only and the actual stages shall be as per TDC and special conditions.

2.) Machining main header shall be preformed after establishing the sample forging (machining, sectioning and examination).

3.) Stages for the sample forgings shall be included in the QAP.

ANNEXURE-II - Clause by clause confirmation of Technical Delivery Conditions
D139-TDC-001 Rev:02

Please tick in Yes / No column based on confirmation / Non-confirmation respectively against each clause.

SL	Criteria	Yes	No	Remarks
1.0	**Scope**			
1.1	This specification prescribes the additional requirements for SA350LF2 Cl.1 forgings conforming to ASME code section III, NB, Cl.1, 2010 Edition.			
2.0	**Applicable Documents**			
2.1	ASME Boiler & Pressure Vessel Code (2010 Edition)			
	(1) Section II, Part A, SA 350 LF2			
	(2) Section III, Subsection NB (Hereinafter referred to as NB)			
3.0	**Requirements**			
3.1	The material shall conform to the requirements of SA350LF2 Cl.1 material specification / and the requirements added by this specification.			
4.0	**Documents to be Submitted** (along with Bid & Prior to Start of Manufacture)			
4.1	Along with Bid: Quality Assurance program, Proposed manufacturing and test plan, Chemical analysis procedure with expected level of trace elements,Heat treatment(HT) plan,applicable test procedures and Packing procedure			
4.2	Prior to Start of Manufacture: (For approval): Forging Drawings, Stage wise Forging plan showing discard of ingot, reduction at each stage, orientation of forging with respect to Ingot and rough forged shape including protrusions if any, UT stage drawings, HT plan including Simulation HT, Material Sampling and Test plan (with sketches for specimen location) including hardness survey on the product and associated test coupons, Stage wise inspection plan including NDE, Cleaning, preservation and packing procedure with particulars of shipping dimension,weight lifting locations and all NDE, Macro, etch & test procedures.			
5.0	**Quantity and Nominal Size**			
5.1	The Quantity and nominal size of Forgings shall be indicated in the applicable drawing referred in Enquiry / Purchase Order (PO).			
6.0	**Material Specification**			
6.1	SA 350 LF 2 Cl.1			
7.0	**Type and Dimension**			
7.1	The fine grained forgings (dished ends and header forgings) shall be Seamless single piece. Header forgings shall be single piece construction with all nozzles (large & small) integral. The forgings shall be supplied in Normalised condition.			
7.2	Dimensions shall be in accordance with applicable drg.			

Please tick in Yes / No column based on confirmation / Non-confirmation respectively against each clause.

SL	Criteria	Yes	No	Remarks
	referred in Enquiry / PO.			
8.0	**Repair by Welding**			
8.1	Repair by welding shall not be permitted.			
8.2	Surface defects can be removed by mechanical means with the approval of BHEL and the defective areas shall be smoothly dressed up with the adjacent surface. The minimum thickness after repair shall meet the drawing / Specification requirements. Purchaser reserves all rights to accept or reject the forgings based on the extent of repair called for.			
9.0	**Manufacture**			
	The steel shall be made by the open-hearth, basic –oxygen, or electric-furnace fully killed and fine grained steel shall be Vacuum degased followed by electroslag remelting.			
9.1	The material shall be forged as close as practicable to the specified shape and size and the forging ratio shall be 4 or more. Single piece headers with all the large and small indegeral nozzles shall be manufactured by forging and machining.			
9.2	The forgings shall be properly machined for the required shape and size as per drawing.			
9.3	Header Nozzles – General			
	The nozzles in the header shall be formed by machining the projected portion/thick wall of the forged shell. The end dimensions of thus formed nozzles shall match the dimensions as per drawings. The supplier shall qualify his manufacturing procedures to the satisfaction of the purchaser, by production of samples as per enclosed sketches. These nozzles shall be made from the same materials and by the same techniques as of the forgings of this specification. All samples and production nozzles shall be examined by ultrasonic and magnetic particle methods. Examination procedures shall satisfy the requirements as specified in this specification. Ultrasonic examination and Magnetic Particle examination shall be conducted and accepted in accordance with the requirements of NB- 2500. Mock up Sample nozzles (each size) as per enclosed sketches (SK:4:D139:001/00, SK:4:D139:002/00, SK-4-D139-003/00, SK-4-D139-004/00) shall be sectioned in two planes through the nozzle centre-line (through and at right angles to the header centre-line), following the specified non- destructive examinations. The sections shall conform to the requirements of respective drawings. One sectioned surface from each quadrant shall be polished, etched and inspected. The material shall be			

Please tick in Yes / No column based on confirmation / Non-confirmation respectively against each clause.

SL	Criteria	Yes	No	Remarks
	free from cracks, tears, injurious inclusions, laminations and other defects. The second sample, machined nozzle as per sketch (SK:4:D139:005/00, SK:4:D139:006/00) shall be allocated for preparation of the nozzle weld qualification coupon.			
9.4	All the nozzle samples, including cut sections, shall be supplied along with the header forgings for purchaser's use.			
10.0	**Chemical Requirements**			
	The steel shall conform to the requirements specified in the following, determined by heat analysis and Product analysis.			
	Composition wt %			
	Carbon 0.30 max			
	Cobalt 0.02 max			
	Sulphur 0.025 max			
	Phosphorus 0.025 max			
	Aluminium 0.04 max			
	Vanadium 0.01 max			
	Chromium 0.25 max			
	Copper 0.30 max			
	Nickel 0.40 max			
	Molybdenum 0.10 max			
	Manganese 0.6 - 1.35			
	Silicon 0.15 – 0.30			
	Additional elements Sn=0.011max, N=0.013max, As=0.025max, Sb=0.007max.			
11.0	**Mechanical Requirements**			
11.1	Extent of test: Each size/heat/HT batch from product sample or identical test coupon			
11.2	Tests Coupons from which Mechanical,Impact and other tests specimens are machined shall be subjected to Simulated Heat Treatment at 600±10 ºC for 6 Hrs.			
11.3	All specified mechanical, metalographic chemical analysis tests shall be conducted on specimens taken from both ends, mid length region and large nozzle cores of each header. The specified minimum test values shall be applicable and complied by specimens of all orientations, Longitutinal, Transverse and Normal.			
11.4	The material shall conform to the mechanical property requirements prescribed in SA 350 LF 2 , Cl.-1. The specimen test method shall be in accordance with SA-370.			
11.5	Determine T_{NDT} by drop weight test/ ASTM E208 / Specimen Type P.No.2. and conduct Charpy V-Notch Test (Cv) in accordance with NB2320/SA370 at a temperature			

Please tick in Yes / No column based on confirmation / Non-confirmation respectively against each clause.

SL	Criteria	Yes	No	Remarks
	T_{NDT}+33ºC, and meet the requirements NB-2330. R_{TNDT} shall not be more than minus 15 ºC. Location and orientation of Test specimens shall be as per NB 2322. Drop weight confimatory tests shall show two no-breaks at minus 15 ºC.			
11.6	Other tests:			
	1. Micro Structure evaluation			
	2. Hardness Test both on the face and along the length (≤197 HB)			
	3. FATT- (Fracture Apperance at transitionTest Temperature) Impact tests shall be conducted on radial specimens at atleast 7 tempertures (- 45^0, -15^0, +0^0, +18^0, -, -, -, ^{0}C) and transition curves (for absorbed energy, lateral expansion, % shear fracture) covering lower and upper shelves shall be drawn for each melt and heat treatment batch.			
	4. Additional Fracture Toughness at 18 ºC (Transverse / normal specimen to obtain 68J and 0.9mm of absorbed energy and Lateral expansion respectively)			
	5. Fatigue as per ASTM E1820 both radial & tangential specimens.			
	6. Bend test - bending at 180º /Mandrel 1 in. (25.4mm)			
	7. Grain size (5 or finer)			
	8. Inclusion rating evaluation			
	9. NDT verification on samples from other Forgings - No Break at -15ºC.			
11.7	Additional mechanical tests(Impact and Drop weight test) on specimens parallel to the Nozzle axis from nozzle protrusions of larger nozzles shall be carried out to confirm achievement of the specified mechanical properties of the Forging material.			
11.8	Measurement of residual stresses			
12.0	**Non Destructive Examination**			
12.1	Ultrasonic Examination shall be performed over the entire volume of forging material by normal and angle beam examination in two opposite axial and 2 opposite circumferential direction and also from header ends with acceptance standard based upon the final thickness of the nozzles in accordance with NB2500.			
12.2	Magnetic particle examination or Liquid penetrant examination shall be performed on all external surfaces and all accessible internal surfaces in accordance with NB-2545 or NB 2546 as applicable.			
12.3	The time of non-destructive examination shall be basd on NB-2557.			

ANNEXURE-II - Clause by clause confirmation of Technical Delivery Conditions
D139-TDC-001 Rev:02

Please tick in Yes / No column based on confirmation / Non-confirmation respectively against each clause.

SL	Criteria	Yes	No	Remarks
12.4	All nondestructive examination personnel performing the required examination shall be qualified in accordance with ASME Section III NB-5520			
12.5	Additional NDE on Nozzle over the entire surface by normal & angle beam examination in two opposite axials and two opposite circumferential directions and also from nozzle top face before machinining to final shape shall be carried out for soundness by volumetric and Surface examination. Acceptance standard shall be based on final nozzle thickness.			
13.0	**Cleanliness**			
13.1	The finished header shall be clean and free from millscale, rust and foreign material			
13.2	All internal surfaces of the header shall be clean to bright metal and free from oxides, embedded, adherent or loose contaminants			
14.0	**Marking**			
	Each forging shall be legibly marked in accordance with NB-2150 and ASME Section II, Part A, SA 350 LF 2 Cl.1 by the material supplier to assure identification of each forging with its Test Certificate and shall contain the below listed items as a minimum.			
	(1) Material manufacturer's name or trademark.			
	(2) Material specification number.			
	(3) size			
	(4) Heat number and Heat treated condition.			
	(5) Header identification number. (Identification by metal stamping is not permitted)			
15.0	**Right to Access**			
	Purchaser and his authorised inspector shall be given free access, at all time while work on the contract is being performed, to all parts of manufacturer's factory that concerns the manufacture of the material ordered.			
16.0	**Submittal Documents with Material**			
16.1	The supplier shall submit all recorded documents as in Clause 4.0 and any other report / procedure called for.			
17.0	**Witness and Hold Point**			
	The test and examination shall be carried out in the presence of the Inspecting Agency authorised by BHEL, wherever specified in the inspection and test plans to be submitted for approval. Each item shall be backed by 5 copies of test certificate furnishing the following details legibly in English language only, duly certified by the inspecting authority:			
	1. Purchase Order No.(BHEL),TDC No. & Test certificate number			

ANNEXURE-II - Clause by clause confirmation of Technical Delivery Conditions
D139-TDC-001 Rev:02

Please tick in Yes / No column based on confirmation / Non-confirmation respectively against each clause.

SL	Criteria	Yes	No	Remarks
	2. Specification and Grade with applicable year of code, Steel making process 3. Quantity & Size, Drg number, Heat Number 4. Chemistry including incidental elements - Ladle and Product analysis. 5. Heat treatment details of the material and test coupons including actual HT charts. 6. Mechanical test results, NDE test results with reference & acceptance standard. 7. Cleaning & Surface treatment details, Dimensional reports.			

ANNEXURE-II - Clause by Clause Confirmations on Special conditions for Manufacture and supply of Reactor headers and dished ends:

Please tick in Yes / No column based on confirmation / Non-confirmation respectively against each clause.

SL	Criteria	Yes	No	Remarks
1	All the above Header and Dished forgings shall be as per relevant drawings, ASME specification **SA350LF2 CL1**, Technical delivery condition No **D139-TDC-001 Rev:02**			
2	Supplier shall submit detailed manufacturing process and inspection plan planned to manufacture the reactor headers and dished ends. The process shall include the steel melting process, forging process, and machining of headers and dished ends.			
3	Header manufacturing guideline Reactor inlet and outlet header wall thickness less than 65.0mm at any point shall be the cause for rejection of such forged shells. However around the integral nozzle openings the wall thickness shall be increased to meet the reinforcement requirements. These large nozzle opening reinforcement and transition shape details given in the drawing shall be met without any deviation. When small integral nozzles for feeders and instrumentation are contoured over the OD by machining operation from a thicker hollow forging, additional tests on radial specimens and additional NDE on the nozzle protrusion shall be carried out to confirm achievement of the specified mechanical properties for the header material along the nozzle axis also and to ensure the required soundness in the integral nozzle protrusions as shown in the drawings.			
4	Test coupons requirements shall be estimated separately and indicate all the sizes/sketches and specimen locations in their offer separately. The respective test coupons shall be made from same melt of the corresponding component. Offers do not contain above details shall not be considered for technical evaluation.			
5	UT examination In addition to TDC point 12.0. Ultrasonic examination shall be performed in accordance with the requirements of NB-2500 of Section III of ASME Code using procedures and standards such as to ensure consistent detection and discrimination of transverse and longitudinal defects. The reference standards shall be made from material of the same composition, diameter, thickness and surface condition and heat treatment conditions as of the material which is to be examined. The width, shape and method of producing the notches may be altered, without sacrificing the defect detection sensitivity, subject to Purchaser's approval. All ultrasonic defect indications shall be investigated to determine the defect characteristics such as size, shape, location and orientation. The basis of acceptance or rejection of components shall be as following: The reference level for straight beam examination shall be 4 mm diameter flat bottomed hole for thickness (t) > 200 mm, 3 mm for t ≤200 mm and + > 100 mm and 2 mm for t ≤ 100 mm and for angle beam examination it shall be a notch 3mm wide x 12 mm long x 0.03 t (3 mm max.) deep.			

ANNEXURE-II - Clause by Clause Confirmations on Special conditions for Manufacture and supply of Reactor headers and dished ends:

Please tick in Yes / No column based on confirmation / Non-confirmation respectively against each clause.

SL	Criteria	Yes	No	Remarks
	Examination of forging must be performed from both thickness faces and from the cylindrical surface with normal beam probes. Additional scanning in the circumferential direction with 35 deg. angle beam probes shall be carried out for forgings. The acceptance standard shall be based on defect standard of CRR (Circular Reference Reflector) dia 1.2mm and notch (U-type notch) dimensions of 1.6 mm max width 2.5mm depth, whichever is stringent and for nozzles dia 0.5mm for normal beam. Since UT examination not feasible after final machining due to the geometry of the finished headers, hence the UT examination shall be carried out in stages. First examination shall be after heat treatment and rough machining. And the second stage examination after first machining of nozzles in cylindrical shapes.			
6	Acceptance Criteria: Products shall not be acceptable if indications of echoes are higher than DAC (or reference level) when UT inspected in straight or angle beam. The results obtained during the ultrasonic examination carried out by supplier form the base line/reference data for future in service inspections to be conducted by the Purchaser. Hence, characteristics of all recordable defect indications within acceptance limits as well as description of ultrasonic procedure and equipment etc. shall be documented in detail such that any of those recordable defect indications could be identified and reproduced at a later date and during the service life of header assemblies, any changes in characteristics of those defect indications could be monitored and compared with respect to the base line/reference data. The documentation shall include sketches or maps showing the recordable defect sites with respect to well defined reference points on the Header Assemblies.			
7	Cleaning and surface treatment procedure shall be submitted to purchaser for approval. All chemicals and fluids such as cleaning agents, penetrants, developers and water used for hydrostatic testing and paints used for marking shall preferably be free from halogen and sulphur. However, in no case more than 25 ppm of halogen and sulphur shall be permitted. Examination materials, chemicals, fluids, or any other material used for examination, inspection and tests shall be removed from the product to achieve a clean-dry surface.			
8	In addition to the examination, inspection and tests mentioned in TDC and special conditions, the finish of all surfaces of component shall be inspected visually as required by the basic SA - Material Specifications. This shall include the use of boroscope, dental, mirrors or any other devices where necessary.			
9	The Purchaser or his authorized agency shall have access to the Manufacturer's or their sub-contractor's premises at all reasonable times and to the extent necessary to assess compliance with the provisions of the said programme and this specification. Examination, inspection and test reports shall be submitted by the Manufacturer to Purchaser.			

ANNEXURE-II - Clause by Clause Confirmations on Special conditions for Manufacture and supply of Reactor headers and dished ends:

Please tick in Yes / No column based on confirmation / Non-confirmation respectively against each clause.

SL	Criteria	Yes	No	Remarks
10	The above forgings are required for 700MWe Nuclear Power plant for KAPP 3&4 & RAPP-7&8 and **"End Use Certificate" will not be given.**			
11	Six sets of additional dialets containing Test Certificate, copies of the approved procedures DCR, Drawings etc .. apart from contractual requirements are required.			
12	Supplier should have experience in handling of similar forgings and production of ESR material, also the supplier has to furnish the test certificate for the similar major components.			
13	Offers from suppliers sourcing materials from China / supplies from China are not acceptable. Offers from Traders are not acceptable.			
14	The supplier shall confirm clause by clause confirmation on the TDC, special conditions and drawing notes along with their offer. Some of the points mentioned in this section, Drawing notes and TDC may be repeated. Offers not confirming the clauses will not be considered for technical evaluation.			
15	**Sample quality plan** is enclosed; the supplier shall consider and submit the quality plan in line with the sample plan along with technical offer by incorporating the appropriate manufacturing activity.			
16	**Inspection:** aa. For Foreign Suppliers: by any of the three approved third parties viz., i) TUV Nord(North) ii) BV and iii) SGS bb. For Indian Suppliers: by BHEL and Customer (NPCIL)			
17	**Notes given in the respective drawing shall be read and confirmed.**			
18	**LIQUIDATED DAMAGES**: If the supplier fails to deliver the materials within the period specified in the contract the purchaser shall deduct as Liquidated Damages (LD), a sum equivalent to 0.5% of the price for each week of delay up to maximum of 15% of the price of the delayed undelivered goods.			
19	**RISK PURCHASE**: Alternatively the purchaser at his option will be entitled to terminate the contract and to purchase elsewhere at the risk and cost of the seller either the whole of the goods or any part which the supplier has failed to deliver or dispatch within the time stipulated as aforesaid or if the same were not available, the best and the nearest available substitutes therefore. The supplier shall be liable for any loss, which the purchaser may sustain by reason of such risk purchases in addition to penalty at the rate mentioned in clause 18 above.			
20	**Validity**: Offer should be valid for minimum 90 days from the date of tender opening.			

SAMPLE QUALITY PLAN

SL NO	OPEARATION	TPI		
		A	B	C
01	Steel melting process and ladle analysis	✓		✓
02	Identification of ingot	✓		✓
03	Forging process	✓	✓	
04	Heat analysis	✓	✓	
05	Rough machining and UT examination	✓		✓
06	Heat treatment	✓	✓	
07	Removal of samples from header	✓		✓
08	Proof machining of header	✓	✓	
09	UT examination on the proof machined header	✓		✓
10	Test material identification	✓		✓
11	Sample material cutting	✓	✓	
12	Product analysis	✓		✓
13	Grain size & structure	✓		✓
14	Simulation HT	✓	✓	
15	Mechanical Test	✓		✓
16	Final machining	✓	✓	
17	Dimensional inspection	✓		✓
18	Proof test	✓		✓
19	Visual inspection	✓	✓	
20	Document/Test certificate verification	✓		✓
21	Preservation and packing	✓		✓
22	TPI certificate	✓		✓
23	Shipping release	✓		✓
24	Establishing the sample forging procedure, machining and examination	✓		✓
25	Include stages of sample forging as indicated Sl no:01 to 23	✓		✓

Legend:
A=Checking test report
B=Checking of material
C=Witnessing of operation

NOTE:

1.) The above stages are indicative only and the actual stages shall be as per TDC and special conditions.

2.) Machining main header shall be preformed after establishing the sample forging (machining, sectioning and examination).

3.) Stages for the sample forgings shall be included in the QAP.

INTEGRITY PACT

Between

Bharat Heavy Electricals Ltd. (BHEL), a company registered under the Companies Act 1956 and having its registered office at "BHEL House", Siri Fort, New Delhi – 110049 (India) hereinafter referred to as "The Principal", which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the ONE PART

and

_____, (description of the party along with address), hereinafter referred to as "The Bidder/ Contractor" which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the OTHER PART

Preamble

The Principal intends to award, under laid-down organizational procedures, contract/s for _____

_____

_____. The Principal values full compliance with all relevant laws of the land, rules and regulations, and the principles of economic use of resources, and of fairness and transparency in its relations with its Bidder(s)/ Contractor(s).

In order to achieve these goals, the Principal will appoint Independent External Monitor(s), who will monitor the tender process and the execution of the contract for compliance with the principles mentioned above.

Section 1 – Commitments of the Principal

1.1 The Principal commits itself to take all measures necessary to prevent corruption and to observe the following principles:-

1.1.1 No employee of the Principal, personally or through family members, will in connection with the tender for, or the execution of a contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.

1.1.2 The Principal will, during the tender process treat all Bidder(s) with equity and reason. The Principal will in particular, before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential / additional information through which the Bidder(s) could obtain an advantage in relation to the tender process or the contract execution.

1.1.3 The Principal will exclude from the process all known prejudiced persons.

1.2 If the Principal obtains information on the conduct of any of its employees which is a penal offence under the Indian Penal Code 1860 and Prevention of Corruption Act 1988 or any other statutory penal enactment, or if there be a substantive suspicion in this regard, the Principal will inform its Vigilance Office and in addition can initiate disciplinary actions.

Section 2 – Commitments of the Bidder(s)/ Contractor(s)

2.1 The Bidder(s)/ Contractor(s) commit himself to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the tender process and during the contract execution.

2.1.1 The Bidder(s)/ Contractor(s) will not, directly or through any other person or firm, offer, promise or give to the Principal or to any of the Principal's employees involved in the tender process or the execution of the contract or to any third person any material, immaterial or any other benefit which he / she is not legally entitled to, in

order to obtain in exchange any advantage of any kind whatsoever during the tender process or during the execution of the contract.

2.1.2 The Bidder(s)/ Contractor(s) will not enter with other Bidder(s) into any illegal or undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.

2.1.3 The Bidder(s)/ Contractor(s) will not commit any penal offence under the relevant IPC/ PC Act; further the Bidder(s)/ Contractor(s) will not use improperly, for purposes of competition or personal gain, or pass on to others, any information or document provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.

2.1.4 The Bidder(s)/ Contractor(s) will, when presenting his bid, disclose any and all payments he has made, and is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.

2.2 The Bidder(s)/ Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.

Section 3 – Disqualification from tender process and exclusion from future contracts

If the Bidder(s)/ Contractor(s), before award or during execution has committed a transgression through a violation of Section 2 above, or acts in any other manner such as to put his reliability or credibility in question, the Principal is entitled to disqualify the Bidders(s)/ Contractor(s) from the tender process or take action as per the separate "Guidelines on Banning of Business dealings with Suppliers/ Contractors" framed by the Principal.

Section 4 – Compensation for Damages

4.1 If the Principal has disqualified the Bidder(s) from the tender process prior to the award according to Section 3, the Principal is entitled to demand and recover the damages equivalent to Earnest Money Deposit/ Bid Security.

4.2 If the Principal has terminated the contract according to Section 3, or if the Principal is entitled to terminate the contract according to section 3, the Principal shall be entitled to demand and recover from the Contractor liquidated damages equivalent to 5% of the contract value or the amount equivalent to Security Deposit/Performance Bank Guarantee, whichever is higher.

Section 5 – Previous Transgression

5.1 The Bidder declares that no previous transgressions occurred in the last 3 years with any other company in any country conforming to the anti-corruption approach or with any other Public Sector Enterprise in India that could justify his exclusion from the tender process.

5.2 If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason.

Section 6 – Equal treatment of all Bidders/ Contractors/ Sub-contractors

6.1 The Bidder(s)/ Contractor(s) undertake(s) to obtain from all sub-contractors a commitment consistent with this Integrity Pact and report Compliance to the Principal. This commitment shall be taken only from those sub-contractors whose contract value is more than 20% of Bidder's/ Contractor's contract value with the Principal. The Bidder(s)/ Contractor(s) shall continue to remain responsible for any default by his Sub-contractor(s).

6.2 The Principal will enter into agreements with identical conditions as this one with all Bidders and Contractors.

6.3 The Principal will disqualify from the tender process all bidders who do not sign this pact or violate its provisions.

Section 7 – Criminal Charges against violating Bidders/ Contractors /Sub-contractors

If the Principal obtains knowledge of conduct of a Bidder, Contractor or Subcontractor, or of an employee or a representative or an associate of a Bidder, Contractor or Subcontractor which constitutes corruption, or if the Principal has substantive suspicion in this regard, the Principal will inform the Vigilance Office.

Section 8 –Independent External Monitor(s)

8.1 The Principal appoints competent and credible Independent External Monitor for this Pact. The task of the Monitor is to review independently and objectively, whether and to what extent the parties comply with the obligations under this agreement.

8.2 The Monitor is not subject to instructions by the representatives of the parties and performs his functions neutrally and independently. He reports to the CMD, BHEL.

8.3 The Bidder(s)/ Contractor(s) accepts that the Monitor has the right to access without restriction to all contract documentation of the Principal including that provided by the Bidder(s)/ Contractor(s). The Bidder(s)/ Contractor(s) will grant the monitor, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his contract documentation. The same is applicable to Sub-contractor(s). The Monitor is under contractual obligation to treat the information and documents of the Bidder(s)/ Contractor(s) / Sub-contractor(s) with confidentiality.

8.4 The Principal will provide to the Monitor sufficient information about all meetings among the parties related to the contract provided such meetings could have an impact on the contractual relations between the Principal and the Contractor. The parties offer to the Monitor the option to participate in such meetings.

8.5 As soon as the Monitor notices, or believes to notice, a violation of this agreement, he will so inform the Management of the Principal and request the Management to discontinue or

take corrective action, or heal the situation, or to take other relevant action. The Monitor can in this regard submit non-binding recommendations. Beyond this, the Monitor has no right to demand from the parties that they act in a specific manner, refrain from action or tolerate action.

8.6 The Monitor will submit a written report to the CMD, BHEL within 8 to 10 weeks from the date of reference or intimation to him by the Principal and, should the occasion arise, submit proposals for correcting problematic situations.

8.7 The CMD, BHEL shall decide the compensation to be paid to the Monitor and its terms and conditions.

8.8 If the Monitor has reported to the CMD, BHEL, a substantiated suspicion of an offence under relevant IPC / PC Act, and the CMD, BHEL has not, within reasonable time, taken visible action to proceed against such offence or reported it to the Vigilance Office, the Monitor may also transmit this information directly to the Central Vigilance Commissioner, Government of India.

8.9 The number of Independent External Monitor(s) shall be decided by the CMD, BHEL.

8.10 The word 'Monitor' would include both singular and plural.

Section 9 – Pact Duration

9.1 This Pact begins and shall be binding on and from the submission of bid(s) by bidder(s). It expires for the Contractor 12 months after the last payment under the respective contract and for all other Bidders 6 months after the contract has been awarded.

9.2 If any claim is made / lodged during this time, the same shall be binding and continue to be valid despite the lapse of this pact as specified as above, unless it is discharged/ determined by the CMD, BHEL.

Section 10 – Other Provisions

10.1 This agreement is subject to Indian Laws and jurisdiction shall be registered office of the Principal, i.e. New Delhi.

10.2 Changes and supplements as well as termination notices need to be made in writing. Side agreements have not been made.

10.3 If the Contractor is a partnership or a consortium, this agreement must be signed by all partners or consortium members.

10.4 Should one or several provisions of this agreement turn out to be invalid, the remainder of this agreement remains valid. In this case, the parties will strive to come to an agreement to their original intentions.

10.5 Only those bidders/ contractors who have entered into this agreement with the Principal would be competent to participate in the bidding. In other words, entering into this agreement would be a preliminary qualification.

----------	----------
For & On behalf of the Principal	For & On behalf of the Bidder/ Contractor
(Office Seal)	(Office Seal)

Place----------

Date----------

Witness: _____	Witness: _____
(Name & Address) _____	(Name & Address)_____
_____	_____