



ལྷན་གཙོ་བོ་ -> ལྷན་མཉམ་ལས་འགུལ་དབང་འཛིན།
PUNATSANGCHHU-I HYDROELECTRIC PROJECT AUTHORITY
OFFICE OF THE CHIEF ENGINEER
GENERATION CIRCLE
Post Box No. 1299, Bjimthangkha, BHUTAN
Telephone No. 00975-2-471517; Fax No. 00975-2-417518
E.mail segenphpa@gmail.com

No:-PHPA/ CE (Gen.)/MEM-2(m)/2016/1496

Dated: 5.10.2016

To,

Shri Anshu Bhatnagar,
Addl. General Manager,
International Operation Division,
Integrated Office Complex,
BHEL, Lodhi Road,
New Delhi-110003.

(Fax No.0091-11-24368837)

Sub: Punatsangchhu-I Hydroelectric Project (6x200MW) - Contract Agreement # MEM-2/2012 - Drawings/ Documents of IPBD -reg.

Ref: BHEL Letter No. MEM-2/BHEL-PHPA/L-0094 dated 06.09.2016

Sir,

Please refer to your Letter Nos. MEM-2/BHEL-PHPA/L-0094 dated 06.09.2016 (received on 14.09.2016) and MEM-2/BHEL-PHPA/L-0095 dated 15.09.2016 (received on 30.09.2016) vide which you have submitted the drawings/ documents of IPBD for approval. The drawings/ documents duly approved, as per details given below, are sent herewith for taking necessary action at your end:

Sl. No.	Description of Drawings	Drawing No.	Rev. No.	Remarks
1	QAP for Isolated Phase Bus Duct, SPVT & NG Cubicle	QP/BD/IP/PHP	09	Approved
2	Single Line Diagram of IPBD	01081210003	05	Approved Subject to submission of Design Calculations of CTs & VTs.
3	Wiring Diagram of NG Cubicle	31081221002	04	Approved

Thanking you,

Yours faithfully,

(Arun Goyal)

Chief Engineer (Gen.)

Encls: As Above.



BHARAT HEAVY ELECTRICALS LIMITED, RUDRAPUR

BHEL/CFP/QC	QUALITY ASSURANCE PLAN FOR SUBMISSION TO CUSTOMER: M/s PUNATSANGCHHU-I HYDROELECTRIC PROJECT AUTHORITY, BHUTAN PROJECT: 6x200MW PUNATSANGCHHU-I HYDROELECTRIC PROJECT IWO NO:12-008-X-1 TO 12-013-X-1	QUALITY ASSURANCE PLAN FOR ISOLATED PHASE BUS DUCT, SAVT & NG CUBICLE	MATERIAL INSPECTION / IN-PROCESS INSPECTION / FINAL INSPECTION	SUB VENDORS / VENDORS / CONTRACTORS WORKS	Doc No. : QP/BD/IP/PHP REV.No.: 09 DATE: 27.02.16 Page 1 of 12
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Sl. No.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLAS S	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
					M	C/N				M	C	N	

1	RAW MATERIAL												
1.1	Aluminium Enclosure (Main/Delta/Tap off)	a) Dimension b) Mechanical test (UTS, PS, %Elong, BT, YS) c) Chemical Composition d) Conductivity at 20° C	B A B A	I T T T	2 pc/lot 2 pc/lot 2 pc/lot 2 pc/lot	2 pc/lot 2 pc/lot 2 pc/lot 2 pc/lot	Main/T-off: Gr 19501/IS 5082 Tap off : Gr.31000/ IS-737	Main/T-off: Gr 19501/IS 5082 Tap off : Gr.31000/ IS-737	TC	P P P P	V V V V	V V V V	TC shall be submitted to PHPA-I for review
1.2	Aluminium Conductor (Main/Delta/Tap off)	a) Dimension b) Conductivity at 20° C c) Mechanical test (UTS, PS, %Elong, BT, YS) d) Chemical Composition	B A A B	I T T T	2 pc/lot 2 pc/lot 2 pc/lot 2 pc/lot	2 pc/lot 2 pc/lot 2 pc/lot 2 pc/lot	Main: Gr 19501 Delta: Gr 19501/63401 T-off:Gr.63401 IS 5082	Main: Gr 19501 Delta: Gr 19501/63401 T-off:Gr.63401 IS 5082	TC	P P P P	V V V V	V V V V	
1.3	Al. Strip for flexible	a) Dimension & finish b) Conductivity at 20° C c) Mechanical test (UTS, PS, %Elong, BT, YS) d) Tin/Silver plating on contact surface(as applicable) e) Chemical composition	B A A B A	VSL/I T T I T	2 pc/lot 2 pc/lot 2 pc/lot 100% 2 pc/lot	2 pc/lot 2 pc/lot 2 pc/lot 2 pc/lot	CONTRACT MEM # : 737 Drg.No./Doc. No. : QP/BD/IP/PHP Rev. : 09 (sheet 1 of 12)	APPROVED		P P P P P	V V V V V	V V V V V	

LEGEND: -

CLASS	TYPE OF CHECK	AGENCY	SCOPE	FORMAT OF RECORD
A: CRITICAL	VSL: VISUAL	M: MANUFACTURER / SUB CONTRACTOR	P: PHPPA-I	TC: TEST CERTIFICATE
B: MAJOR	I: MEASUREMENT	C: BHEL / NOMINATED INSPECTION AGENCY	V: REVIEW OF TC	OS: OBSERVATION SHEET
C: MINOR	T: TEST	N: CUSTOMER (PHPA-I)	W: WITNESS	Drg.: DRAWING
			CHP: CUSTOMER HOLD POINT	Ch.List: CHECK LIST

*REPORT OF TYPE TEST CONDUCTED ON SIMILAR ITEM WILL BE ACCEPTABLE (FOR SL No 2.1 to 2.13)

Prepared & Checked by

Reviewed by

Approved by

Faraaz Ali
 (Faraaz Ali)
 Sr Engineer (Q.C.)
 Sr Engg. (Qty. Control)
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Bimal Banerjee
 Sr Manager (Quality & Vigilance)
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 Uttarakhand-263153

(Customer-PHPA-I)



BHARAT HEAVY ELECTRICALS LIMITED, RUDRAPUR

BHEL/CFP/QC	QUALITY ASSUARANCE PLAN FOR SUBMISSION TO	QUALITY ASSUARANCE PLAN FOR	MATERIAL INSPECTION / IN-PROCESS INSPECTION / FINAL INSPECTION	SUB VENDORS / VENDORS / CONTRACTORS WORKS	Doc No. : QP/BD/IP/PHP REV.No.: 09 DATE: 27.02.16 Page 2 of 12
	CUSTOMER: M/s PUNATSANGCHHU-I HYDROELECTRIC PROJECT AUTHORITY, BHUTAN	ISOLATED PHASE BUS DUCT, SAVT & NG CUBICLE			
	PROJECT: 6x200MW PUNATSANGCHHU-I HYDROELECTRIC PROJECT				
	IWO NO:12-008-X-1 TO 12-013-X-1				

Sl. No.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLAS S	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
					M	C/N				M	C	N	
1.4	Copper Strip, Sheet & Plate	a) Dimension & finish	B	VSL/I	2 pc/lot	2 pc/lot	IS-1897	IS-1897	TC	P	V	V	
		b) Mechanical test (UTS, PS, %Elong, BT, YS)	A	T	2 pc/lot	2 pc/lot				P	V	V	
		c) Conductivity at 20° C	A	T	2 pc/lot	2 pc/lot				P	V	V	
		d) Tin/Silver plating on contact surface (as applicable)	B	I	100%	2 pc/lot				P	V	V	
		e) Chemical composition	B	T	2 pc/lot	2 pc/lot				P	V	V	
1.5	Steel Structure (ISMB/ISMC/ISA)	a) Tensile Strength	A	T	1 pc/lot	1 pc/lot	IS-2062	IS-2062		P	V	V	TC shall be submitted to PHPA-I for review
		b) % Elongation	B	T	1 pc/lot	1 pc/lot				P	V	V	
		c) Bend Test (if applicable)	B	T	1 pc/lot	1 pc/lot				P	V	V	
		d) Chemical Composition	B	T	1 pc/lot	1 pc/lot				P	V	V	
2.0	Bought out Items												
2.1	Epoxy resin cast Insulator (Type-A)	a) Visual	B	VSL	100%	10%	IS-9431 & Drg. IS-9431 & Drg.	TC		P	W	V	
	b) Dimension	A	I	2 pc/lot	2 pc/lot	P				W	V		
	c) Creepage Distance	A	I	2 pc/lot	2 pc/lot	P				W	V		
	d) Dry Power frequency with stand for one mln.	A	T	100%	10%	P				W	V		
	e) Partlal discharge	A	T	2 pc/lot	2 pc/lot	P				W	V		
	f) Temp cycle test	A	T	1 pc/lot	1 pc/lot	P				V	V		
	*g) Tests for mechanical	A	T	1 piece	1 piece	P	V	V					

CONTRACT MEM #..... 2/2012
 Drg.No./Doc. No..... QP/BD/IP/PHP
 Rev..... 09 (Sheet 2 of 12)
 APPROVED
 Engineer in-charge
 PHPA-I: Bjimthangkha

LEGEND: -

CLASS	TYPE OF CHECK	AGENCY	SCOPE	FORMAT OF RECORD
A: CRITICAL	VSL: VISUAL	M: MANUFACTURER / SUB CONTRACTOR	P: PERFORMER	TC: TEST CERTIFICATE
B: MAJOR	I: MEASUREMENT	C: BHEL / NOMINATED INSPECTION AGENCY	V: REVIEW OF TC	OS: OBSERVATION SHEET
C: MINOR	T: TEST	N: CUSTOMER (PHPA-I)	W: WITNESS	Drg.: DRAWING
			CHP: CUSTOMER HOLD POINT	Ch.List: CHECK LIST

*REPORT OF TYPE TEST CONDUCTED ON SIMILAR ITEM WILL BE ACCEPTABLE (FOR SL No 2.1 to 2.13)

Prepared & Checked by

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Reviewed by

Bimal Banerjee
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 BHEL, Rudrapur
 Uttarakhand-263153

Approved by

(Customer-PHPA-I)



BHARAT HEAVY ELECTRICALS LIMITED, RUDRAPUR

BHEL/CFP/QC	QUALITY ASSURANCE PLAN FOR SUBMISSION TO CUSTOMER: M/s PUNATSANGCHHU-I HYDROELECTRIC PROJECT AUTHORITY, BHUTAN PROJECT: 6x200MW PUNATSANGCHHU-I HYDROELECTRIC PROJECT IWO NO: 12-008-X-1 TO 12-013-X-1	QUALITY ASSURANCE PLAN FOR ISOLATED PHASE BUS DUCT, SAVT & NG CUBICLE	MATERIAL INSPECTION / IN-PROCESS INSPECTION / FINAL INSPECTION	SUB VENDORS / VENDORS / CONTRACTORS WORKS	Doc No. : QP/BD/IP/PHP REV.No.: 09 DATE: 27.02.16 Page 3 of 12
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Sl. No.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLAS S	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
					M	C/N				M	C	N	
2.2	Epoxy Seal Off bushing	strength	A	T	1 piece	1 piece	CONTRACT MEM # 9/2012 Drg.No./Doc.No. QP/BD/IP/PHP Rev. 09 (Sheet 3 of 12)	APPROVED BHEL Drg./ IS-9431/IS-2099 BHEL Drg./ IS-9431/IS-2099 Engineer In-charge PHPA-I: Bjimthangkha	TC	P	V	V	TC shall be submitted to PHPA-I for review
		*h) Impulse voltage withstand	B	T	1 piece	1 piece				P	V	V	
		*i) Water absorption test	B	T	1 piece	1 piece				P	V	V	
		*j) Deflection under load	B	T	1 piece	1 piece				P	V	V	
		*k) Ageing & humidity	B	T	1 piece	1 piece				P	V	V	
		*l) Flammability Test	B	T	1 piece	1 piece				P	V	V	
		*m) Test for mechanical bending strength as a function of temperature	B	T	1 piece	1 piece				P	V	V	
		a) Dimension	B	I	2 pc/lot	2 pc/lot				P	W	V	
		b) Dry Power frequency withstand for one min.	B	T	2 pc/lot	2 pc/lot				P	V	V	
		c) Partial Discharge	B	T	2 pc/lot	2 pc/lot				P	V	V	
d) Creepage Distance	B	I	2 pc/lot	2 pc/lot	P	W	V						
*e) Impulse voltage withstand	B	T	1 piece	1 piece	P	V	V						
*f) Wet Power Frequency withstand test	B	T	1 piece	1 piece	P	V	V						
*g) Mechanical load test	B	T	1 piece	1 piece	P	V	V						

LEGEND:-

CLASS	TYPE OF CHECK	AGENCY	SCOPE	FORMAT OF RECORD
A: CRITICAL	VSL: VISUAL	M: MANUFACTURER / SUB CONTRACTOR	P: PERFORMER	TC: TEST CERTIFICATE
B: MAJOR	I: MEASUREMENT	C: BHEL / NOMINATED INSPECTION AGENCY	V: REVIEW OF TC	OS: OBSERVATION SHEET
C: MINOR	T: TEST	N: CUSTOMER (PHPA-I)	W: WITNESS	Drg.: DRAWING
			CHP: CUSTOMER HOLD POINT	Ch.List: CHECK LIST

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Prepared & Checked by

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 BHEL, Rudrapur
 263155 Uttarakhand-263155

Approved by

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BHARAT HEAVY ELECTRICALS LIMITED, RUDRAPUR

BHEL/CFP/QC

QUALITY ASSURANCE PLAN FOR SUBMISSION TO
CUSTOMER: M/s PUNATSANGCHHU-I
HYDROELECTRIC PROJECT AUTHORITY, BHUTAN
PROJECT: 6x200MW PUNATSANGCHHU-I
HYDROELECTRIC PROJECT
IWO NO:12-008-X-1 TO 12-013-X-1

QUALITY ASSURANCE PLAN FOR ISOLATED PHASE BUS DUCT, SAVT & NG CUBICLE

MATERIAL INSPECTION / IN-PROCESS INSPECTION / FINAL INSPECTION

SUB VENDORS / VENDORS / CONTRACTORS WORKS

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Sl. No.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
					M	C/N				M	C	N	
2.3	Rubber Expansion Bellow	a) Visual & Dimension	B	VSL/I	100%	10%	BHEL Drg./BS 2752	BHEL Drg./BS 2752	TC	P	W	V	TC shall be submitted to PHPA-I for review
		*b) Ageing test	B	T	1 piece	1 piece				P	V	V	
		c) Shore Hardness	A	T	1 piece	1 piece				P	W	V	
		d) Flame Test	B	T	1 piece	1 piece				P	W	V	
		e) Compressibility	A	T	1 piece	1 piece				P	V	V	
		f) Insulation resistance test	B	T	1 piece	1 piece				P	W	V	
		g) Tensile strength	B	T	1 piece	1 piece				P	V	V	
		h) % Elongation	B	T	1 piece	1 piece				P	V	V	
2.4	Neutral Grounding Resistor	a) Visual & dimensional	B	VSL/I	100%	100%	IEEE-32/ BHEL Appd Drg.	IEEE-32/ BHEL Appd Drg.	TC	P	W	W	CHP TC shall be submitted to PHPA-I for review
		b)Routine Test	B	T	100%	100%				P	W	W	
		i) Power frequency high voltage withstand test	B	T	100%	100%				P	W	W	
		ii) Insulation resistance measurement	B	T	100%	100%				P	W	W	
		*c) Type Test	B	T	1 piece	1 piece				P	V	V	
2.5	Neutral Grounding Transformer (Dry Type)	a)Visual & Dimension	B	VSL/I	100%	100%	IS-11171/ BHEL Appd Drg.	IS-11171/ BHEL Appd Drg.	TC	P	W	W	CHP
		b)Routine Test	B	T	100%	100%				P	W	W	

CONTRACT MEM # 2/2012
 Drg.No./Doc No. QP/BD/IP/PHP
 Rev. 09 (Sheet 4 of 12)

APPROVED
 Engineer In-charge
 PHPA-I: Bjimthangkha

LEGEND: -

CLASS	TYPE OF CHECK	AGENCY	SCOPE	FORMAT OF RECORD
A: CRITICAL	VSL: VISUAL	M: MANUFACTURER / SUB CONTRACTOR	P: PERFORMER	TC: TEST CERTIFICATE
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Prepared and Checked by

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(Customer-PHPA-I)



BHARAT HEAVY ELECTRICALS LIMITED, RUDRAPUR

BHEL/CFP/QC	QUALITY ASSURANCE PLAN FOR SUBMISSION TO CUSTOMER: M/s PUNATSANGCHHU-I HYDROELECTRIC PROJECT AUTHORITY, BHUTAN PROJECT: 6x200MW PUNATSANGCHHU-I HYDROELECTRIC PROJECT IWO NO: 12-008-X-1 TO 12-013-X-1	QUALITY ASSURANCE PLAN FOR ISOLATED PHASE BUS DUCT, SAVT & NG CUBICLE	MATERIAL INSPECTION / IN-PROCESS INSPECTION / FINAL INSPECTION	SUB VENDORS / VENDORS / CONTRACTORS WORKS	Doc No. : QP/BD/IP/PHP REV.No.: 09 DATE: 27.02.16 Page 5 of 12
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Sl. No.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS			
					M	C/N				M	C	N				
2.6	Voltage Transformer	resistance of all winding on rated voltage	B	T	100%	100%	CONTRACT MEM # 2/2012 Drg.No./Doc. No. QP/BD/IP/PHP Rev. 09 (Sheet 5 of 12)	APPROVED Engineer In-charge PHPA-I: Bjimthangkha	TC	P	W	W	} CHP TC shall be submitted to PHPA-I for review CHP			
		ii) Ratio Test		T	100%	100%				P	W	W				
		iii) Polarity, marking & phase relation	T	100%	100%	P				W	W					
		iv) Excitation loss and current at rated voltage	T	100%	100%	P				W	W					
		v) Impedance, voltage & power at rated current	T	100%	100%	P				W	W					
		vi) Power frequency/ HV withstand test	T	100%	100%	P				W	W					
		vii) IR measurement	T	100%	100%	P				W	W					
		viii) Induced voltage withstand test	T	100%	100%	P				W	W					
		ix) Separate source withstand test	T	100%	100%	P				W	W					
		*c) Type Test														
		i) Temp Rise Test	B	T	1 piece	1 piece				P	V	V		} CHP		
		ii) Impulse Test	B	T	1 piece	1 piece				P	V	V				
		a) Visual & Dimension	B	VSL/I	100%	100%				BHEL Appd Drg./ IS- 3156	BHEL Appd Drg./ IS- 3156	TC		P	W	W
b) Routine Test																
i) Verification of terminal	B	T	100%	100%				P	W	W	CHP					

LEGEND: -

CLASS A: CRITICAL B: MAJOR C: MINOR	TYPE OF CHECK VSL: VISUAL I: MEASUREMENT T: TEST	AGENCY M: MANUFACTURER / SUB CONTRACTOR C: BHEL / NOMINATED INSPECTION AGENCY N: CUSTOMER (PHPA-I)	SCOPE P: PERFORMER V: REVIEW OF TC W: WITNESS CHP: CUSTOMER HOLD POINT	FORMAT OF RECORD TC: TEST CERTIFICATE OS: OBSERVATION SHEET Drg.: DRAWING Ch.List: CHECK LIST
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Reviewed by
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 BHEL, Rudrapur
 Uttarakhand-263153

Approved by
 (Customer-PHPA-I)



BHARAT HEAVY ELECTRICALS LIMITED, RUDRAPUR

QUALITY ASSUARANCE PLAN FOR SUBMISSION TO
CUSTOMER: M/s PUNATSANGCHHU-I
HYDROELECTRIC PROJECT AUTORITY, BHUTAN
PROJECT: 6x200MW PUNATSANGCHU-I
HYDROELECTRIC PROJECT
IWO NO:12-008-X-1 TO 12-013-X-1

QUALITY ASSUARANCE PLAN FOR ISOLATED PHASE BUS DUCT, SAVT & NG CUBICLE

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Sl. No.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLAS S	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
					M	C/N				M	C	N	
2.7	Current Transformer	marking, polarity & ratio	B	T	100%	100%	CONTRACT MEMO No. 2/2012 Drg.No./Doc. No. QP/BD/IP/PHP Rev. 09 (Sheet 6 of 12) BHEL Appd Drg./ IS- 2705 BHEL Appd Drg./ IS- 2705 Engineer in-charge PHPA-I: Brijbhushan	TC	P	W	W	} CHP	
		ii) Determination of errors	B	T	100%	100%			P	W	W		
		iii) Partial discharge test	B	T	100%	100%			P	W	W		
		iv) Power frequency/ HV withstand test	B	T	100%	100%			} TC shall be submitted to PHPA-I for review				
		*c) Type Test	B	T	1 piece	1 piece				P	V	V	
		i) Impulse Test	B	T	1 piece	1 piece				P	V	V	
		ii) Heat Run Test	B	T	1 piece	1 piece			P	V	V	} CHP	
		iii) Accuracy Limit Test	B	T	1 piece	1 piece			P	V	V		
		a) Visual & Dimension	B	VSL/I	100%	100%			P	W	W		
		b) Routine Test	B	T	100%	100%			P	W	W		
		i) Verification of terminal marking and polarity	A	T	100%	100%			P	W	W		
		ii) Power Frequency Test on primary and secondary windings	A	T	100%	100%			P	W	W		
iii) Over voltage inter-turn test	A	T	100%	100%	P	W	W						
iv) Determination of error according to requirement of appropriate accuracy class	A	T	100%	100%	P	W	W						

LEGEND :-

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 263153

Approved by
 (Customer-PHPA-I)



BHARAT HEAVY ELECTRICALS LIMITED, RUDRAPUR

BHEL/CFP/QC

QUALITY ASSURANCE PLAN FOR SUBMISSION TO
CUSTOMER: M/s PUNATSANGCHHU-I
HYDROELECTRIC PROJECT AUTHORITY, BHUTAN
PROJECT: 6x200MW PUNATSANGCHU-I
HYDROELECTRIC PROJECT
IWO NO:12-008-X-1 TO 12-013-X-1

QUALITY ASSURANCE PLAN FOR ISOLATED PHASE BUS DUCT, SAVT & NG CUBICLE

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Sl. No.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
					M	C/N				M	C	N	
2.8	Lightning Arrester	v) Partial Discharge Measurement	A	T	100%	100%	<p align="center">CONTRACT MEM # 3/2013 Fig.No./Doc.No. QP/BD/IP/PHP 09 (Sheet 7 of 13)</p> <p align="center">APPROVED</p> <p align="center">Engineer In-charge PPHA-I: Bimthandkha</p> <p align="center">BHEL Appd. Drg/ IEC-99.4/15-3070 BHEL Appd. Drg/ IEC-99.4/15-3070</p>	TC	P	W	W	} CHP } TC shall be submitted to PPHA-I for review } CHP	
		vi) Current error, phase displ- cement & composite error	A	T	100%	100%			P	W	W		
		vii) Knee point voltage & excitation current (For PS class)	B	T	100%	100%			P	W	W		
		viii) Turns Ratio	A	T	100%	100%			P	W	W		
		*c) Type Test											
		i) Temp. Rise Test	A	T	1 piece	1 piece			P	V	V		
		ii) Impulse Test	A	T	1 piece	1 piece			P	V	V		
		a) Visual & Dimension	B	I	100%	100%			P	W	W		
		b) Creepage distance	B	I	100%	100%			P	W	W		
		c) Acceptance Tests											
		i) PF ref. voltage test	A	T	100%	100%			P	W	W		
		ii) Lightning impulse residual voltage test	A	T	100%	100%			P	W	W		
		iii) Seal leakage test	A	T	100%	100%			P	W	W		
iv) Partial discharge test	A	T	100%	100%	P	W	W						
*g) Type Tests													
i) Partial discharge test	B	T	1 piece	1 piece	P	V	V						

LEGEND: -

CLASS	TYPE OF CHECK	AGENCY	SCOPE	FORMAT OF RECORD
A: CRITICAL	VSL: VISUAL	M: MANUFACTURER / SUB CONTRACTOR	P: PERFORMER	TC: TEST CERTIFICATE
B: MAJOR	I: MEASUREMENT	C: BHEL / NOMINATED INSPECTION AGENCY	V: REVIEW OF TC	OS: OBSERVATION SHEET
C: MINOR	T: TEST	N: CUSTOMER (PPHA-I)	W: WITNESS	Drg.: DRAWING
			CHP: CUSTOMER HOLD POINT	Ch.List: CHECK LIST

*REPORT OF TYPE TEST CONDUCTED ON SIMILAR ITEM WILL BE ACCEPTABLE (FOR SL No 2.1 to 2.13)

Prepared & Checked by
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 Sr. Engg. (Qty. Control)
 (Faraaz Ali) रूद्रपुर BHEL, Rudrapur
 Sr Engineer (QTY)
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Reviewed by
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 Sr Manager (Quality & Vigilance)
 (B BANERJEE) रूद्रपुर BHEL, Rudrapur
 Sr Manager (QTY)
 उत्तराखण्ड - 263153 Uttarakhand-263153

Approved by
 (Customer-PPHA-I)



BHARAT HEAVY ELECTRICALS LIMITED, RUDRAPUR

QUALITY ASSURANCE PLAN FOR SUBMISSION TO
CUSTOMER: M/s PUNATSANGCHHU-I
HYDROELECTRIC PROJECT AUTHORITY, BHUTAN
PROJECT: 6x200MW PUNATSANGCHHU-I
HYDROELECTRIC PROJECT
IWO NO:12-008-X-1 TO 12-013-X-1

QUALITY ASSURANCE PLAN FOR ISOLATED PHASE BUS DUCT, SAVT & NG CUBICLE

MATERIAL INSPECTION / IN-PROCESS INSPECTION / FINAL INSPECTION

SUB VENDORS / VENDORS / CONTRACTORS WORKS

Doc No. :
QP/BD/IP/PHP
REV.No.: 09
DATE: 27.02.16
Page 8 of 12

Sl. No.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
					M	C/N				M	C	N	
2.9	Surge Capacitor	ii) Insulation withstand test	B	T	1 piece	1 piece	<p>CONTRACT MEM # <u>2/2012</u> Drg.No./Doc. No. <u>QP/BD/IP/PHP</u> Rev. <u>09 (Sheet 8 of 12)</u></p> <p>APPROVED</p> <p>BHEL Appd Drg/ IS-11548 Engineer in charge PHPA-I: Bjimthangkha</p>	TC	TC	P	V	V	TC shall be submitted to PHPA-I for review
		iii) Long duration current impulse withstand test	B	T	1 piece	1 piece				P	V	V	
		iv) Operation duty test	B	T	1 piece	1 piece				P	V	V	
		v) Residual Voltage Test	B	T	1 piece	1 piece				P	V	V	
		vi) Power frequency voltage versus time curve	B	T	1 piece	1 piece				P	V	V	
		vii) Pressure relief test	B	T	1 piece	1 piece				P	V	V	
		viii) Artificial Pollution Test	B	T	1 piece	1 piece				P	V	V	
		a) Dimension	B	I	100%	100%				P	W	W	
		b) Acceptance Test	A	T	100%	100%	P	W	W				
		i) Measurement of capacitance	A	T	100%	100%	P	W	W				
		ii) Di electric loss angle	A	T	100%	100%	P	W	W				
		iii) Capacitor loss test	A	T	100%	100%	P	W	W				
		iv) DC voltage between terminals	A	T	100%	100%	P	W	W				
		v) Efficacy of discharge device	A	T	100%	100%	P	W	W				
vi) Sealing test	A	T	100%	100%	P	W	W						

LEGEND: -

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			CHP: CUSTOMER HOLD POINT	Ch.List: CHECK LIST

*REPORT OF TYPE TEST CONDUCTED ON SIMILAR ITEM WILL BE ACCEPTABLE (FOR SL No 2.1 to 2.13)

Prepared & Checked by
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 Sr Engineer (Q.Y.) 263153 Uttarakhand-263153

Reviewed by
बिमल बनर्जी Bimal Banerjee
 Sr. Manager (Quality & Vigilance)
 (BIMANERJEE) BHEL, Rudrapur
 Sr. Manager (Q.Y.) Uttarakhand-263153

Approved by
 (Customer-PHPA-I)



BHARAT HEAVY ELECTRICALS LIMITED, RUDRAPUR

QUALITY ASSURANCE PLAN FOR SUBMISSION TO
CUSTOMER: M/s PUNATSANGCHHU-I
HYDROELECTRIC PROJECT AUTHORITY, BHUTAN
PROJECT: 6x200MW PUNATSANGCHHU-I
HYDROELECTRIC PROJECT
IWO NO:12-008-X-1 TO 12-013-X-1

QUALITY ASSURANCE PLAN FOR ISOLATED PHASE BUS DUCT, SAVT & NG CUBICLE

MATERIAL INSPECTION / IN-PROCESS INSPECTION / FINAL INSPECTION

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Sl. No.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
					M	C/N				M	C	N	
2.10	Hot Air Blowing equipment	*c) Type Test	B	T	1 Piece	1 Piece	BHEL Appd Drg. IS-325 / IS-11989	BHEL Appd Drg. IS-325 / IS-11989	TC	P	V	V	TC shall be submitted to PHPA-I for review
		i) Impulse Test								P	V	V	
		ii) Measurement of capacitance								P	V	V	
		iii) Thermal stability test								P	V	V	
		iv) Short circuit discharge test								P	V	V	
		v) Partial discharge test								P	V	V	
		vi) Drop Hammer Test								P	V	V	
		vii) Verification of container protection against corrosion	P	V	V								
		a) Visual/Dimension	B	VSL/I	100%	100%				P	W	V	
		b) Routine Test	B	T	100%	100%				P	W	V	
i) Performance test quality of air delivered and discharge pressure	B	T	100%	100%	P	W	V						
ii) Temperature rise at outlet air	B	T	100%	100%	P	W	V						
iii) Internal function	B	T	100%	100%	P	W	V						

CONTRACT MEM # 2/2012
 Drg.No./Doc.No. QP/BD/IP/PHP
 09 (Sheet 9 of 12)

APPROVE

BHEL Appd Drg. IS-325 / IS-11989
 BHEL Appd Drg. IS-325 / IS-11989
 HPA-I: Bijnibangha

LEGEND: -

CLASS
 A: CRITICAL
 B: MAJOR
 C: MINOR

TYPE OF CHECK
 VSL: VISUAL
 I: MEASUREMENT
 T: TEST

AGENCY
 M: MANUFACTURER / SUB CONTRACTOR
 C: BHEL / NOMINATED INSPECTION AGENCY
 N: CUSTOMER (PHPA-I)

SCOPE
 P: PERFORMER
 V: REVIEW OF TC
 W: WITNESS
 CHP: CUSTOMER HOLD POINT

FORMAT OF RECORD
 TC: TEST CERTIFICATE
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 Ch.List: CHECK LIST


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Prepared & Checked by

Faraaz Ali
 Sr. Engg. (Qty. Control)
 BHEL, Rudrapur
 Uttarakhand - 263153

Reviewed by **Bimal Banerjee**
 Sr. Manager (Quality & Vigilance)
 BHEL, Rudrapur
 Uttarakhand-263153

Approved by
 (Customer-PHPA-I)

 BHEL/CFP/QC	BHARAT HEAVY ELECTRICALS LIMITED, RUDRAPUR				
	QUALITY ASSURANCE PLAN FOR SUBMISSION TO CUSTOMER: M/s PUNATSANGCHHU-I HYDROELECTRIC PROJECT AUTHORITY, BHUTAN PROJECT: 6x200MW PUNATSANGCHHU-I HYDROELECTRIC PROJECT IWO NO:12-008-X-1 TO 12-013-X-1	QUALITY ASSURANCE PLAN FOR ISOLATED PHASE BUS DUCT, SAVT & NG CUBICLE	MATERIAL INSPECTION / IN-PROCESS INSPECTION / FINAL INSPECTION	SUB VENDORS / VENDORS / CONTRACTORS WORKS	Doc No. : QP/BD/IP/PHP REV.No.: 09 DATE: 27.02.16 Page 10 of 12


Sl. No.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS						
					M	C/N				M	C	N							
2.11	Steel support structure	a) Dimension	B	T	1 pc/lot	1 pc/lot	BHEL Drg IS-2629/ IS-2633	BHEL Drg IS-2629/IS-2633	TC	P	W	V	TC shall be submitted to PHPA-I for review						
		b) Galvanizing	B	T	1 pc/lot	1 pc/lot				P	W	V							
		i) Mass of zinc coating	B	T	1 pc/lot	1 pc/lot				P	W	V							
		ii) Adhesion Test	B	T	1 pc/lot	1 pc/lot				P	W	V							
2.12	H.T. Fuse	a) Measurement of resistance	B	I	100%	10%	Drg.No./Doc.No. IS-402-2 Rev. 09 (Sheet 10 of 12)	BHEL Drg / Spec	BHEL Drg / Spec	TC	P	W		V					
		2.13	Hardware (Nut, bolt, washer)	a)Dimensions	B	I					3 pc/lot	3 pc/lot		BHEL Drg / Spec	BHEL Drg / Spec	TC	P	V	V
				b) Class / grade	B	T					3 pc/lot	3 pc/lot					P	V	V
				3.0 Fabrication	3.1 Enclosure & Conductor Fabrication	a) Dimension					B	I					100%	10%	BHEL Drg BS-159
b) DP test on Weld	A	T	100%			10%	120% variation in resistance of plain to welded cond.	P	W	V									
c) mV drop test on straight butt joint on conductor	A	T	1 pc/lot			1 pc/lot		P	W	V									
d) Silver plating on palm (if required)	B	T	10%			10%	P	W	V										

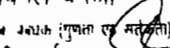
CONTRACT MEMO # 9/2012
 Drg.No./Doc.No. QP/BD/IP/PHP
 Rev. 09 (Sheet 10 of 12)
 APPROVED
 Engineer in Charge
 PHPA-I: Bimal Banerjee

LEGEND: -

CLASS	TYPE OF CHECK	AGENCY	SCOPE	FORMAT OF RECORD
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			CHP: CUSTOMER HOLD POINT	Ch.List: CHECK LIST

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Prepared & Checked by

Faraaz Ali
 Sr. Engg. (Qty. Control)
 (Faraaz Ali, अनिवंता (गुणता) Sr. Engg. (Qty. Control)
 Sr Engineer (कौशल, ई.एल. रुद्रपुर BHEL, Rudrapur
 उत्तराखण्ड - 263153 Uttarakhand-263153

अनुमोदित/Checked by

Bimal Banerjee
 Sr. Manager (Quality & Vigilance)
 (Bimal Banerjee) BHEL, Rudrapur
 उत्तराखण्ड - 263153 Uttarakhand-263153
 Sr. Manager (QLY)

Approved by
 (Customer-PHPA-I)



BHARAT HEAVY ELECTRICALS LIMITED, RUDRAPUR

QUALITY ASSURANCE PLAN FOR SUBMISSION TO
CUSTOMER: M/s PUNATSANGCHHU-I HYDROELECTRIC PROJECT AUTHORITY, BHUTAN
PROJECT: 6x200MW PUNATSANGCHHU-I HYDROELECTRIC PROJECT
IWO NO:12-008-X-1 TO 12-013-X-1

QUALITY ASSURANCE PLAN FOR ISOLATED PHASE BUS DUCT, SAVT & NG CUBICLE

MATERIAL INSPECTION / IN-PROCESS INSPECTION / FINAL INSPECTION

SUB VENDORS / VENDORS / CONTRACTORS WORKS

Doc No. : QP/BD/IP/PHP
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Sl. No.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLAS S	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS			
					M	C/N				M	C	N				
3.2	Disconnecting links, shorting links / bar	a) Visual	B	VSL	100%	100%	BHEL Drg	BHEL Drg	OS / TC	P	V	V	TC shall be submitted to PHPA-I for review			
		b) Dimension	B	I	100%	10%				P	V	V				
		c) Conductivity	A	T	1 pc/lot	1 pc/lot				P	V	V				
		d) Silver plating (if reqd)	B	T	1 pc/lot	1 pc/lot				P	V	V				
4.0	ASSEMBLY															
4.1	Enclosure & Conductor Assembly	a) Dimension	A	I	100%	10%	BHEL Drg / Approved Lay out	BHEL Drg / Approved Lay out	OS	P	W	W	} CHP			
		b) Distance between Insulator	A	I	100%	10%				P	W	W				
		c) Painting thickness & adhesion test	A	T	100%	10%				P	W	W				
4.2	SAVT & NG Cubicle Assembly	a) Dimension	A	I	100%	100%	BHEL Drg / Approved Layout	BHEL Drg / Approved Layout	OS	P	W	W	} CHP			
		b) Raw material of sheet (chemical, mechanical tests)	B	T	1 pc/lot	1 pc/lot				P	V	V				
		c) Wiring	A	T	100%	100%				P	W	W				
		i) Visual														
		ii) Continuity														
		iii) 2 KV Test														
	d) HV Test	A	T	100%	100%				P	W	W	} CHP				
	e) Paint thickness & adhesion	B	T	Random	Random				P	W	W					
	*f) Degree of protection	B	T	1 piece	1 piece				P	V	V					

CONTRACT MEMO 2/2012
 Drg.No./Doc.No. QP/BD/IP/PHP
 09 (Sheet 11 of 12)
APPROVED

LEGEND: -

CLASS
 A: CRITICAL
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 VSL: VISUAL
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Prepared & Checked by

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 263153 Uttarakhand-263153

Reviewed by **Bimal Banerjee**
 Sr Manager (Quality & Vigilance)
 BHEL, Rudrapur
 263153 Uttarakhand-263153
 Sr Manager (QLY)

Approved by

(Customer-PHPA-I)



BHARAT HEAVY ELECTRICALS LIMITED, RUDRAPUR

QUALITY ASSUARANCE PLAN FOR SUBMISSION TO
CUSTOMER: M/s PUNATSANGCHHU-I
HYDROELECTRIC PROJECT AUTORITY, BHUTAN
PROJECT: 6x200MW PUNATSANGCHHU-I
HYDROELECTRIC PROJECT
IWO NO:12-008-X-1 TO 12-013-X-1

QUALITY ASSUARANCE PLAN FOR
ISOLATED PHASE BUS DUCT,
SAVT & NG CUBICLE

MATERIAL INSPECTION / IN-PROCESS
INSPECTION / FINAL INSPECTION

SUB VENDORS /
VENDORS /
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Doc No. :
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REV.No.: 09
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Page 12 of 12

Sl. No.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLAS S	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
					M	C/N				M	C	N	
5.0	Final testing on Bus Duct	g)Verification of BOM	B	VSL	100%	100%				P	W	W	CHP
5.1	Routine Test	a) Dimension	B	I	100%	10%	IS-8084	IS-8084	TC	P	W	W	
		b) Finish	B	VSL	100%	Random				P	W	W	
		c) Marking	B	VSL	100%	Random				P	W	W	
		d) Power frequency/ HV with stand test for 1 min	A	T	100%	10%				P	W	W	
		e) IR	A	T	100%	10%				P	W	W	
		f) Measurement of power loss (on 1 piece of Main, Delta & Tap-off)	A	T	1 piece	1 piece				P	W	W	
5.2	Type test on Main, Delta & Tap-off Bus Duct	a)Short time current test	A	T	1 Piece	1 Piece	IS 8084	IS 8084	TC	P	W	W	
		b) Temperature rise test	A	T	1 Piece	1 Piece				P	W	W	
		c) Power frequency voltage	A	T	1 Piece	1 Piece				P	W	W	
		d) Impulse voltage test	A	T	1 Piece	1 Piece				P	W	W	
5.3	Special tests	a) Water tightness	A	T	1 Piece	1 Piece	IS-8084	IS-8084	TC	P	W	W	

CONTRACT MEM # 2/2012
 Drg.No./Doc.No. QP/BD/IP/PHP
 Rev. BS-159 09 (Sheet 12 of 12)

APPROVED
 IS 8084
 Engineer In-charge
 PHPA-I: Bjimthangkha

LEGEND: -

CLASS	TYPE OF CHECK	AGENCY	SCOPE	FORMAT OF RECORD
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Reviewed by

Bimal Banerjee
 Manager (Quality & Vigilance)
 BHEL, Rudrapur
 263153 Uttarakhand-263153

Approved by

(Customer-PHPA-I)

FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN MM

01081210003

VT DETAILS

VT NO.	RATIO	WINDING	BURDEN	ACCURACY CLASS	LOCATION	QTY.	FUNCTION
VT-1	$\frac{13.8}{\sqrt{3}} / \frac{0.110}{\sqrt{3}}$ KV	1	60VA	0.2	SAVT CUBICLE	003	AVR CHANNEL-1
VT-2	$\frac{13.8}{\sqrt{3}} / \frac{0.110}{\sqrt{3}}$ KV	1	60VA	0.2	SAVT CUBICLE	003	AVR CHANNEL-2
VT-3	$\frac{13.8}{\sqrt{3}} / \frac{0.110}{\sqrt{3}}$ KV	1	30VA	3P	SAVT CUBICLE	003	PROTECTION
VT-4	$\frac{13.8}{\sqrt{3}} / \frac{0.110}{\sqrt{3}}$ KV	1	60VA	0.2	SAVT CUBICLE	003	METERING/SYNCHRONIZATION

LA DETAILS-18KV,10KA, DISCHARGE CLASS: 3

SC DETAILS-18KV,0.25MICRO FARAD

NGT DETAILS-13.8/.25KV,44KVA CONTINUOUS
207KVA FOR ONE MINUTE

NGR DETAILS-13.8/.25KV,0.14 OHMS WITH DUTY
CYCLE OF 30 SEC

CT-DETAILS

C.T. NO.	LOCATION	RATIO	ACC. CLASS	BURDEN	Vk =>	QTY. (NO.)	NOMINAL VOLTAGE (KV)	FUNCTION
CT-101	GEN. BUSDUCT NEUTRAL SIDE	12000/5A	PS	-	200Rct+160	003	13.8	GEN. & TRANSF. OVERALL DIFF. PROTN.
CT-102	GEN. BUSDUCT NEUTRAL SIDE	12000/5A	0.2	50	-	003	13.8	UCB METERING
CT-103	GEN. BUSDUCT NEUTRAL SIDE	12000/5A	5P20	10	-	003	13.8	GEN. PROTECTION
CT-104	GEN. BUSDUCT NEUTRAL SIDE	12000/5A	PS	-	200Rct+160	003	13.8	SPARE
CT-105	GEN. BUSDUCT NEUTRAL SIDE	12000/5A	PS	-	120Rct+80	003	13.8	GEN. DIFF. PROTECTION
CT-106	GEN. BUSDUCT LINE SIDE	12000/5A	0.2	50	-	003	13.8	AVR
CT-107	GEN. BUSDUCT LINE SIDE	12000/5A	0.2	50	-	003	13.8	AVR
CT-108	GEN. BUSDUCT LINE SIDE	12000/5A	PS	-	120Rct+80	003	13.8	SPARE
CT-109	GEN. BUSDUCT LINE SIDE	12000/5A	PS	-	120Rct+80	003	13.8	GEN. DIFF. PROTECTION
CT-110	GEN. BUSDUCT LINE SIDE	12000/5A	PS	-	85Rct+125	003	13.8	GEN. TRANSF. DIFF. PROTECTION
CT-111	ET TAP-OFF INSIDE CUBICLE	100/1A	5P20	5	-	003	13.8	INSTANT AND TIME DELAY O/C PROTN.
CT-112	GEN. BUSDUCT TAP-OFF TO UAT	50/1A	5P20	5	-	003	13.8	SPARE
CT-113	GEN. BUSDUCT TAP-OFF UAT	50/1A	5P20	5	-	003	13.8	INSTANT & TIME DELAY O/C PROTN.
CT-114	GEN. BUSDUCT TAP-OFF SAT	250/1A	5P20	5	-	003	13.8	INSTANT & TIME DELAY O/C PROTN.
CT-115	GEN. BUSDUCT TAP-OFF SAT	12000/5A	PS	-	200Rct+160	003	13.8	OVERALL DIFF. PROTECTION
CT-116	GEN. BUSDUCT TAP-OFF SAT	250/1A	PS	-	24Rct+30	003	13.8	DIFF. PROTECTION

CONTRACT MEM# 2/2012
Drg.No./Doc.No. 01081210003
05

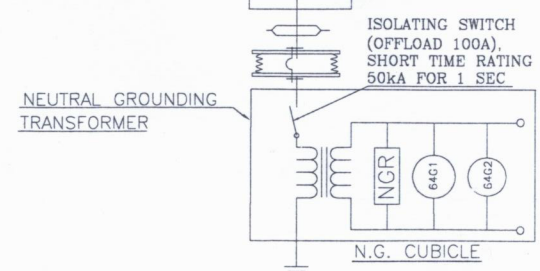
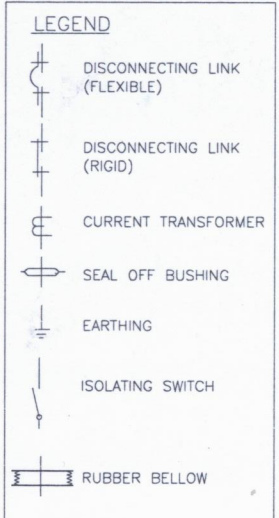
APPROVED
Subject to submission of Design Calculations of CTs & VTs.
Engineer Incharge
PHPA-I: Bjimthangkha

Reference Drawing-Single Line Relaying and Metering Diagram,Drg No.-
Drg No.-1259-PUNAT-1-P-30,Rev-R5

NOTE: CT-111, 64G1 AND 64 G2 ARE NOT IN SCOPE OF BHEL-RUDRAPUR.
(CT-111 IS IN SCOPE OF BHEL-JHANSI.)

FOR APPROVAL ONLY

CUSTOMER	PHPA BHUTAN						
CUSTOMER'S CONSULTANT	WAPCOS LIMITED CENTRAL ELECTRICITY AUTHORITY						
PROJECT	6x200MW PUNATSANGCHHU-I HEP						
	BHARAT HEAVY ELECTRICALS LIMITED RUDRAPUR						
REV. DATE	ALTERED	REV. DATE	ALTERED	REV. DATE	ALTERED	REV. DATE	ALTERED
05 01/08/15	CHECKED A.NARAYAN	04 20/06/15	CHECKED	03 15/05/15	CHECKED	02 22/04/15	CHECKED
REVISED BASED ON CUSTOMER COMMENTS DATED 18/07/15.		REVISED BASED ON CUSTOMER COMMENTS DATED 08/06/15.		REVISED BASED ON CUSTOMER COMMENTS DATED 14/05/15.		REVISED BASED ON CUSTOMER COMMENTS DATED 08/01/15.	
REVISED BASED ON CUSTOMER COMMENTS DATED 30/08/14.							
TITLE SINGLE LINE DIAGRAM OF IPBD							
DEPT. SCALE NYS DRAWING NO. 01081210003				SHEET 1 OF 1 REV. 05			

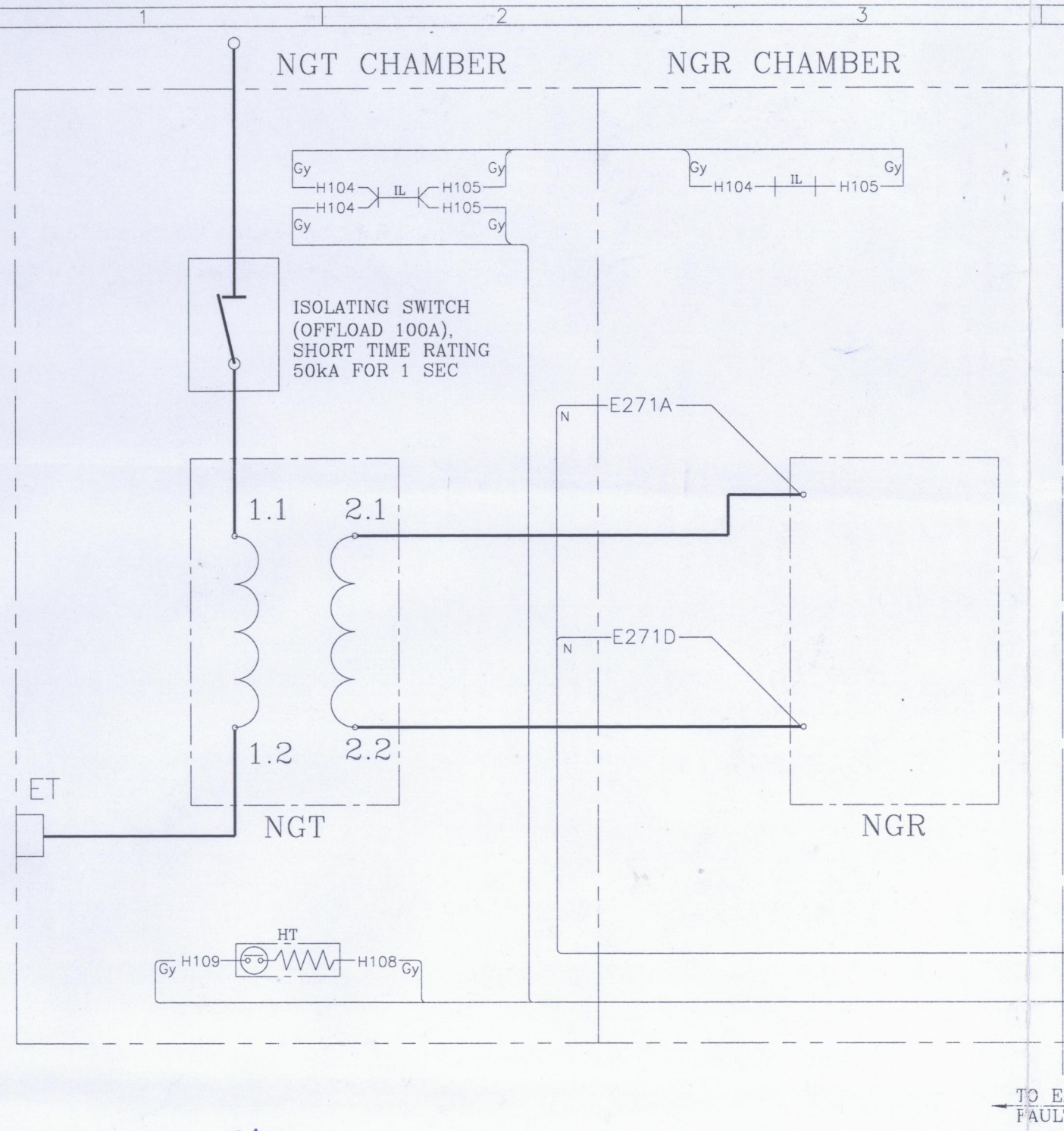


REV. DATE	ALTERED	REV. DATE	ALTERED	REV. DATE	ALTERED	REV. DATE	ALTERED
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REVISED BASED ON CUSTOMER COMMENTS DATED 30/08/14.							

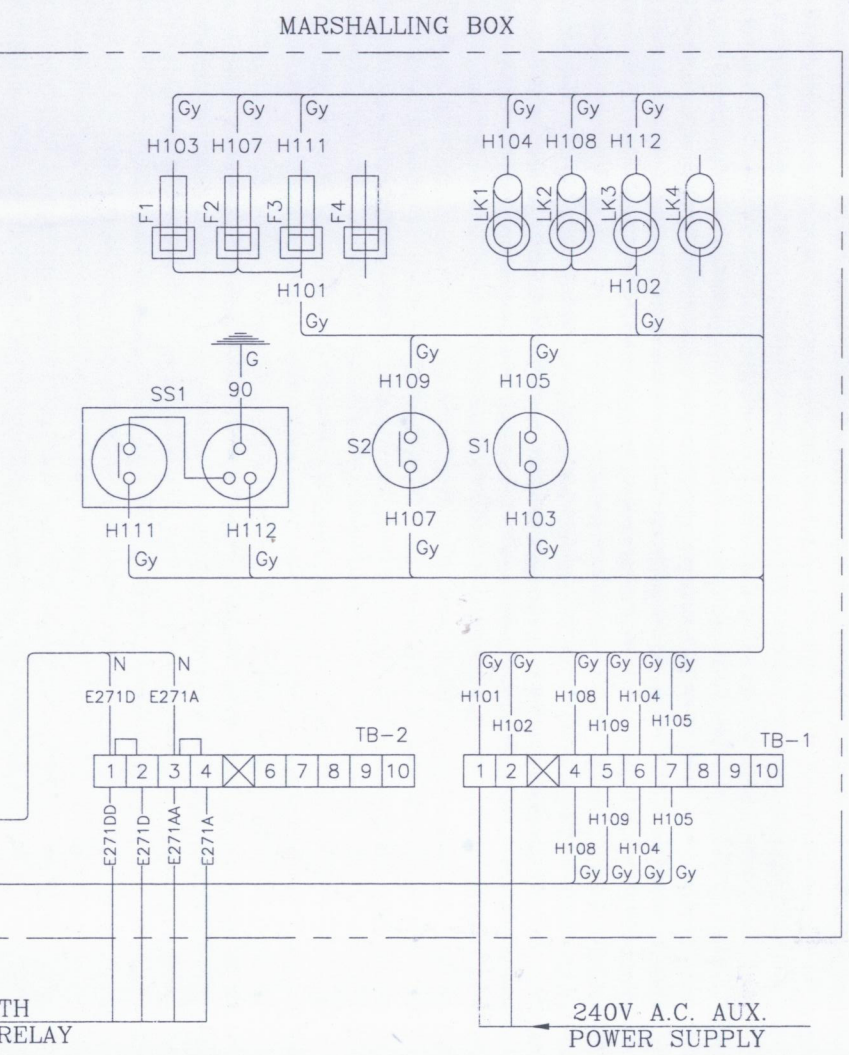
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it must not be used directly or indirectly in any way detrimental to the interest of the company.

ELECTRONIC FILE NAME

DRAWING NO. 3 1 08 12 21 002
FIRST ANGLE PROJECTION
ALL DIMENSIONS IN MILLIMETER
COPYRIGHT & CONFIDENTIAL THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY DETRIMENTAL TO THE INTEREST OF THE COMPANY.



- NOTES:-**
1. WIRING WILL BE DONE WITH 2.5MM SQ. FRLS INSULATED 1100V COPPER WIRES CONFORMING TO IS 1554(PART-1) AND DOUBLE COMPRESSION Ni-Cr PLATED BRASS HEAVY DUTY CABLE GLANDS AND CRIMPING TYPE TINNED COPPER LUGS.
 2. SUITABLE EXTRA LENGTH OF WIRES(APPROX.150MM)TO BE PROVIDED DURING WIRING AS LOOPS.
 3. ALL FUSES ARE OF HRC LINK TYPE.
 4. LINKS ARE PROVIDED IN FUSE FITTING.
 5. WIRING CONTINUITY & 2KV TEST TO BE CONDUCTED.
 6. TERMINAL BLOCKS FOR ALL CIRCUITS SHALL BE SUITABLE FOR CONNECTING MIN. 2 NOS. OF 2.00SQMM COPPER FLEXIBLES.
 7. TERMINAL BLOCKS OF NON FERROUS WITH FIRE RETARDANT, UNBREAKABLE POLYAMIDE 6.6 OF V0 CLASS, SLIDING DISCONNECTING TYPE WITH FULLY ENCLOSED REMOVAL COVERS SHALL BE PROVIDED.



WIRE COLOUR CODE
 N - BLACK
 Gy - GREY
 G - GREEN

FUSE DTAIL

FUSE	RATING	LABEL
F1	2A	HEATER
F2	2A	LIGHT
F3	6A	SOCKET
F4	6A	SPARE

LINK DETAIl

LINK	LABEL
LK1	HEATER
LK2	LIGHT
LK3	SOCKET
LK4	SPARE

LEGEND

IL -FLUORESCENT LAMP 240V,20W
 LK -LINK
 ET -EARTHING TERMINAL
 S1 -SWITCH FOR FLUOROSCEN TUBE
 S2 -SWITCH FOR HEATER
 TB -TERMINAL BOX
 HT -SPACE HEATER WITH THERMOSTATE (250V,100W)

NGT -NEUTRAL GROUNDING TRFR. (13.8kv/250V,AN, 44kVA CONTINUOUS, 207kVA FOR ONE MINUTE)
 NGR -NEUTRAL GROUNDING RESISTOR. (250V, 0.14 OHM)

FOR APPROVAL

CONTRACT MEM #.....2/2012.....
 Drg.No./Doc. No.....31081221002.....
 Rev.....04.....

APPROVED

 Engineer in Charge
 PHPA-I: Bjimthangkha

REV.	DATE	ALTERD	REV.	DATE	ALTERD
		CHEKED			CHEKED

ADDITIONAL INFORMATION		PROJECT	6x200MW PUNATSANGCHHU-I HEP																						
STATUS OF DRAWING		CUSTOMER	PHPA BHUTAN																						
DISTRIBUTION OF PRINTS		CONSULTANT	WAPCOS LIMITED CENTRAL ELECTRICITY AUTHORITY																						
<table border="1"> <thead> <tr> <th>DRN</th> <th>NAME</th> <th>SIGN</th> <th>DATE</th> <th>NO. OF VAR.</th> </tr> </thead> <tbody> <tr> <td>S.P.S</td> <td>-sd-</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>CKD</td> <td>SURAJ</td> <td>-sd-</td> <td>-</td> <td>-</td> </tr> <tr> <td>APPDR</td> <td>K.LAL</td> <td>-sd-</td> <td>-</td> <td>-</td> </tr> </tbody> </table>		DRN	NAME	SIGN	DATE	NO. OF VAR.	S.P.S	-sd-	-	-	-	CKD	SURAJ	-sd-	-	-	APPDR	K.LAL	-sd-	-	-	CONTRACTOR	 BHARAT HEAVY ELECTRICALS LTD. RUDRAPUR		
DRN	NAME	SIGN	DATE	NO. OF VAR.																					
S.P.S	-sd-	-	-	-																					
CKD	SURAJ	-sd-	-	-																					
APPDR	K.LAL	-sd-	-	-																					
SUB-SUPPLIER/VENDOR		ISSUED BY	UNTL.DIMS. GR.	ANGLE	SCALE																				
		DEPT. CODE	C/M/F	NTS	NTS																				
		TITLE	WIRING DIAGRAM OF N.G. CUBICLE		DRAWING NO. 3 1 08 12 21 002																				
				REV. 04	SHT. No. 01 NO. OF SHT. 01 A3																				



ཕྱག་ལུ་གཟུང་ཚུ་-༢ ལྷོ་ག་མེ་ལས་འགུལ་དབང་འཛིན།

PUNATSANGCHHU-II HYDROELECTRIC PROJECT AUTHORITY
OFFICE OF THE ADDITIONAL SUPERINTENDING ENGINEER
(ELECTRO MECHANICAL-I CIRCLE)
BJIMTHANGKHA, WANGDUE PHODRANG
Telephone No: 02-471601, Fax No: 02-471602
E-Mail: seem1phpa2@gmail.com



PHPA-II/ASE(E&M-I)/EM-2/1/2016/ 1273

Date: 10.12.2016

**Shri Anshu Bhatnagar, AGM,
M/s Bharat Heavy Electricals Limited,
International Operation Division,
5th Floor, Integrated Office Complex,
Lodhi Road, New Delhi-110003
Fax No.:0091-11-2468406/24367130**

**Sub: Punatsangchhu-II HEP (6x170MW), Bhutan – Contract Package
EM#2 – QAP of Isolated Phase Bus Ducts, SAVT and NG Cubicle –
Reg.**

Sir,

Please refer BHEL letter No. IO/PHPA-II/EM-2/039 dated 22.10.2016 enclosing therewith the QAP for "Isolated Phase Bus Ducts, SAVT and NG Cubicle"

The document along with the clarification furnished by BHEL to our earlier comments / observations has been examined and we have no comments to offer on the same.

Thanking you,

Yours faithfully,


Parupkar Singh 10.12.16
(Addl. SE(E&M-I))

Copy to: Shri Arvind Dev, Chief Engineer (E&M), WAPCOS w.r.t. letter No. WAP/E&M/P-II/EM-2/2016/2874 dated 18.11.016.

NOO Copy to:

1. ASE ,(E&M-I), Div-II



Ref No: IO/PHPA-II/EM-2/039
Dated: 22nd Oct' 2016

विषय / Sub : 6 X 170 MW Punatsangchhu HE Project , Bhutan
EM-2 Package – Final Submission of QAPs

Ref.: 1st DCM (9-12 Aug'16) at CEA New Delhi


Sir,

We are enclosing QAP for following equipment for **final stamped approval**.

1. Isolated phase Bus ducts - QP/BD/IP /PHPA-II – REV.06 (Annexure-1).

Kindly send the approved QAP at the earliest.

Yours sincerely,


For Anshu Bhatnagar
(AGM – IO)

Sh. Parupkar Singh
Additional Superintending Engineer (EM-1)
Punatsangchhu-II Hydroelectric Project,
G-21, Bjimthangkha, Wangduephodrang, Bhutan

Encl: aa



COVER SHEET FOR QUALITY ASSURANCE PLAN

REFERENCE DOC : QAP PHPA II
REV: 06
DATED: 21.10.16

DOCUMENT NAME : QUALITY ASSURANCE PLAN FOR ISOLATED PHASE BUSDUCT ,SPVT & NG CUBICLE.

DOCUMENT No: QP/BD/IP/PHPA-II ,REV No: 06

PROJECT : 6 X 170 MW PUNATSANGCHHU –II HYDRO ELECTRIC PROJECT, BHUTAN

CUSTOMER:



M/s PUNATSANGCHHU –II HYDRO ELECTRIC PROJECT AUTHORITY, BHUTAN. (6 X 170 MW), BHUTAN

CONSULTANTS:



WAPCOS LIMITED(A GOVERNMENT OF INDIA UNDERTAKING



CENTRAL ELECTRICITY AUTHORITY(CEA)

SUPPLIER:



BHARAT HEAVY ELECTRICALS LIMITED ,COMPONENT FABRICATION PLANT(CFP), RUDRAPUR, UTTRAKHAND

PREPARED BY: Ravindra Kumar
(Sr.Engineer)

APPROVED BY: Bimal Banerjee
(Sr.Manager)

CUSTOMER APPROVAL:

DATED: 21.10.16

DATED: 21.10.16

DATED:



BHEL/CFP/QC

BHARAT HEAVY ELECTRICALS LIMITED, RUDRAPUR

QUALITY ASSURANCE PLAN FOR SUBMISSION
 CUSTOMER : M/s PUNATSANGCHHU-II
 HYDROELECTRIC PROJECT AUTHORITY, BHUTAN
 PROJECT: 6 X 170 MW PUNATSANGCHHU-II
 HYDROELECTRIC PROJECT
 IWO NO.: 0063-X-1 TO 13-0068-X-1

QUALITY ASSURANCE PLAN FOR ISOLATED
 PHASE BUS DUCT, LAVT & NG CUBICLE

MATERIAL INSPECTION / INPROCESS
 INSPECTION / FINAL INSPECTION

SUB-VENDORS /
 VENDORS /
 CONTRACTORS WORKS

DOC NO.: QP/BD/IP/PHAP-II
 REV. NO.: 06
 DATE: 21.10.2016

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK (TYPE OF TEST)	QUANTUM OF CHECK			REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
					M	C	N				M	C	N	
1	RAW MATERIAL													
1.1	Aluminium Enclosure (Main/Delta/Tap-Off)	a) Dimension b) Mechanical Test (UTS, PS, % Elong, BT, YS) c) Chemical Composition d) Conductivity at 20° C	B A B A	I T(M) T T(E)	2 PC/LOT 2 PC/LOT 2 PC/LOT 2 PC/LOT	2 PC/LOT 2 PC/LOT 2 PC/LOT 2 PC/LOT	2 PC/LOT 2 PC/LOT 2 PC/LOT 2 PC/LOT	Main/T-Off: Gr: 19501 IS: 5082 Tap-Off: Gr. 31000 IS: 737	Main/T-Off Gr: 19501 IS: 5082 Tap-Off Gr. 31000 IS: 737	TC	P P P P	V V V V	V V V V	TC SHALL BE SUBMITTED TO PHPA-II FOR REVIEW
1.2	Aluminium Conductor (Main/Delta/Tap-Off)	a) Dimension b) Conductivity at 20° C c) Mechanical Test (UTS, PS, % Elong, BT, YS) d) Chemical Composition	B A B A	I T(E) T(M) T	2 PC/LOT 2 PC/LOT 2 PC/LOT 2 PC/LOT	2 PC/LOT 2 PC/LOT 2 PC/LOT 2 PC/LOT	2 PC/LOT 2 PC/LOT 2 PC/LOT 2 PC/LOT	Main: Gr 19501 Delta: Gr 19501 63401 Tap-Off: Gr. 63401 IS: 5082	Main: Gr 19501 Delta: Gr 19501 63401 Tap-Off: Gr. 63401 IS: 5082	TC	P P P P	V V V V	V V V V	TC SHALL BE SUBMITTED TO PHPA-II FOR REVIEW
1.3	Al. Strip for flexible	a) Dimension & finish b) Conductivity at 20° C c) Mechanical test (UTS, PS, %Elong, BT, YS) d) Tin/Silver plating on contact surface(as applicable) e) Chemical composition	B A A B A	VSL/I T(E) T(M) I T	2 PC/LOT 2 PC/LOT 2 PC/LOT 100% 2 PC/LOT	2 PC/LOT 2 PC/LOT 2 PC/LOT 2 PC/LOT 2 PC/LOT	2 PC/LOT 2 PC/LOT 2 PC/LOT 2 PC/LOT 2 PC/LOT	IS: 737	IS: 737	TC	P P P P P	V V V V V	V V V V V	TC SHALL BE SUBMITTED TO PHPA-II FOR REVIEW
1.4	Copper Strip, Sheet & Plate	a) Dimension & finish b) Mechanical test (UTS, PS, %Elong, BT, YS) c) Conductivity at 20° C d) Tin/Silver plating on contact surface (as applicable) e) Chemical composition	B A A B A	VSL/I T(M) T(E) I T	2 PC/LOT 2 PC/LOT 2 PC/LOT 100% 2 PC/LOT	2 PC/LOT 2 PC/LOT 2 PC/LOT 2 PC/LOT 2 PC/LOT	2 PC/LOT 2 PC/LOT 2 PC/LOT 2 PC/LOT 2 PC/LOT	IS: 1897	IS: 1897	TC	P P P P P	V V V V V	V V V V V	TC SHALL BE SUBMITTED TO PHPA-II FOR REVIEW

Ravindra



BHARAT HEAVY ELECTRICALS LIMITED, RUDRAPUR

BHEL/CFP/QC

QUALITY ASSURANCE PLAN FOR SUBMISSION
CUSTOMER : M/s PUNATSANGCHHU-II
HYDROELECTRIC PROJECT AUTHORITY, BHUTAN
PROJECT: 6 X 170 MW PUNATSANGCHHU-II
HYDROELECTRIC PROJECT
IWO NO.: 0063-X-1 TO 13-0068-X-1

QUALITY ASSURANCE PLAN FOR ISOLATED
PHASE BUS DUCT, LAVT & NG CUBICLE

MATERIAL INSPECTION / INPROCESS
INSPECTION / FINAL INSPECTION

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DOC NO.: QP/BD/IP/PHAP
II
REV. NO.: 06
DATE: 21.10.2016

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK (TYPE OF TEST)	QUANTUM OF CHECK			REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
					M	C	N				M	C	N	
2	BOUGHT OUT ITEMS													
2.1	Epoxy resin cast Insulator (Type-A)	a) Visual b) Dimension c) Creepage Distance d) Dry Power frequency with stand for one min	B A A A	VSL I I T(E)	100% 2 PC/LOT 2 PC/LOT 100%	10% 2 PC/LOT 2 PC/LOT 10%	10% 2 PC/LOT 2 PC/LOT 10%	IS: 9431 & DRG	IS: 9431 & DRG	TC	P P P P	W W W W	V V V V	TC SHALL BE SUBMITTED TO PHPA-II FOR REVIEW
		e) Partial discharge f) Temp cycle test *g) Tests for mechanical Strength *h) Impulse voltage withstand *i) Water absorption test *j) Deflection under load *k) Test for Mechanical Bending Strength as a function of strength *l) Ageing and Humidity test	A A A A B B B A	T(E) T T(M) T(E) T(E) T(M) T(M) T(E)	2 PC/LOT 2 PC/LOT 1 PIECE 1 PIECE 1 PIECE 1 PIECE 1 PIECE 1 PIECE	2 PC/LOT 2 PC/LOT 1 PIECE 1 PIECE 1 PIECE 1 PIECE 1 PIECE 1 PIECE	2 PC/LOT 2 PC/LOT 1 PIECE 1 PIECE 1 PIECE 1 PIECE 1 PIECE 1 PIECE	IS: 9431 & DRG	IS: 9431 & DRG	TC	P P P P P P P P	W V V V V V V V	V V V V V V V V	TC SHALL BE SUBMITTED TO PHPA-II FOR REVIEW
2.2	Epoxy Seal Off Bushing	a) Dimension b) Dry Power frequency withstand for one min. c) Partial Discharge d) Creepage Distance *e) Impulse voltage withstand	B B B B B	I T(E) T(E) I T(E)	2 PC/LOT 2 PC/LOT 2 PC/LOT 2 PC/LOT 1 PIECE	2 PC/LOT 2 PC/LOT 2 PC/LOT 2 PC/LOT 1 PIECE	2 PC/LOT 2 PC/LOT 2 PC/LOT 2 PC/LOT 1 PIECE	BHEL DRG IS: 9431 IS: 2099	BHEL DRG IS: 9431 IS: 2099	TC	P P P P P	W V V W V	V V V V V	TC SHALL BE SUBMITTED TO PHPA-II FOR REVIEW
2.3	Rubber Expansion Bellow	a) Visual & Dimension *b) Ageing test c) Shore Hardness d) Flame Test e) Compressibility f) Insulation resistance test g) Tensile strength h) % Elongation	B B A B A B B B	VSL/I T(M) T(M) T(E) T T(E) T(M) T(M)	100% 1 PIECE 1 PC/LOT 1 PC/LOT 1 PC/LOT 1 PC/LOT 1 PC/LOT 1 PC/LOT	10% 1 PIECE 1 PC/LOT 1 PC/LOT 1 PC/LOT 1 PC/LOT 1 PC/LOT 1 PC/LOT	10% 1 PIECE 1 PC/LOT 1 PC/LOT 1 PC/LOT 1 PC/LOT 1 PC/LOT 1 PC/LOT	BHEL DRG BS: 2752	BHEL DRG BS: 2752	TC	P P P P P P P P	W V W W V W V V	V V V V V V V V	TC SHALL BE SUBMITTED TO PHPA-II FOR REVIEW

Rawindra



BHEL/CFP/QC

BHARAT HEAVY ELECTRICALS LIMITED, RUDRAPUR

QUALITY ASSURANCE PLAN FOR SUBMISSION
CUSTOMER : M/s PUNATSANGCHHU-II
HYDROELECTRIC PROJECT AUTHORITY, BHUTAN
PROJECT : 6 X 170 MW PUNATSANGCHHU-II
HYDROELECTRIC PROJECT
IWO NO.: 0063-X-1 TO 13-0068-X-1

QUALITY ASSURANCE PLAN FOR ISOLATED
PHASE BUS DUCT, LAVT & NG CUBICLE

MATERIAL INSPECTION / INPROCESS
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DOC NO.: QP/BD/IP/PHAP
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REV. NO.: 06
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SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK (TYPE OF TEST)	QUANTUM OF CHECK			REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
					M	C	N				M	C	N	
2.4	Neutral Grounding Resistor	a) Visual & dimensional	B	VSL/I	100%	100%	100%	IEEE-32 BHEL APPD DWG	IEEE-32 BHEL APPD DWG	TC	P	W	W	CHP
		b) Routine Test	B	T(E)	100%	100%	100%				P	W	W	
		i) Power frequency high voltage withstand Test ii) Insulation Resistance measurement *c) Type Test	B	T(E)	100%	100%	100%				P	W	W	
2.5	Neutral Grounding Transformer (Dry Type)	i) Temp Rise Test (Part Resistance test)	B	T(E)	1 Piece	1 Piece	1 Piece	IS: 11171 BHEL APPD DRG.	IS: 11171 BHEL APPD DRG.	TC	P	V	V	CHP
		a) Visual & Dimension	B	VSL/I	100%	100%	100%				P	W	W	
		b) Routine Test	B	T(E)	100%	100%	100%				P	W	W	
		i) Measurement of resistance of all winding on rated voltage	B	T(E)	100%	100%	100%				P	W	W	
		ii) Ratio Test	B	T(E)	100%	100%	100%				P	W	W	
		iii) Polarity, marking & phase relation	B	T(E)	100%	100%	100%				P	W	W	
		iv) Excitation loss and current at rated voltage	B	T(E)	100%	100%	100%				P	W	W	
		v) Impedance, voltage & power at rated current	B	T(E)	100%	100%	100%				P	W	W	
		vi) Power frequency/ HV withstand test	B	T(E)	100%	100%	100%				P	W	W	
		vii) IR measurement	B	T(E)	100%	100%	100%				P	W	W	
		viii) Induced voltage withstand test	A	T(E)	100%	100%	100%				P	W	W	
ix) Separate source withstand test	A	T(E)	100%	100%	100%	P	W	W						
*c) Type Test														
		i) Temp Rise Test	B	T(E)	1 PIECE	1 PIECE	1 PIECE				P	V	V	
		ii) Impulse Test	B	T(E)	1 PIECE	1 PIECE	1 PIECE				P	V	V	

Rawndig



BHARAT HEAVY ELCTRICALS LIMITED, RUDRAPUR

BHEL/CFP/QC

QUALITY ASSURANCE PLAN FOR SUBMISSION
CUSTOMER : M/s PUNATSANGCHHU-II
HYDROELECTRIC PROJECT AUTHORITY, BHUTAN
PROJECT: 6 X 170 MW PUNATSANGCHHU-II
HYDROELECTRIC PROJECT
IWO NO.: 0063-X-1 TO 13-0068-X-1

QUALITY ASSURANCE PLAN FOR ISOLATED
PHASE BUS DUCT, LAVT & NG CUBICLE

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DOC NO.: QP/BD/IP/PHAP-II
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SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK (TYPE OF TEST)	QUANTUM OF CHECK			REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS		
					M	C	N				M	C	N			
2.6	Voltage Transformer	a) Visual & Dimension	B	VSL/I	100%	100%	100%	BHEL APPD DRG IS: 3156	BHEL APPD DRG IS: 3156	TC	P	W	W	GHP		
		b) Routine Test														
		i) Verification of terminal marking, polarity & ratio	B	T(E)	100%	100%	100%				P	W	W			
		ii) Determination of errors	B	T(E)	100%	100%	100%				P	W	W			
		iii) Partial discharge test	B	T(E)	100%	100%	100%				P	W	W			
iv) Power frequency dry withstand test on primary	B	T(E)	100%	100%	100%	P	W	W								
2.7	Current Transformer	& secondary windings.														
		*c) Type Test														
		i) Impulse Test	B	T(E)	1 PIECE	1 PIECE	1 PIECE				P	V	V			
		ii) Heat Run Test	B	T(E)	1 PIECE	1 PIECE	1 PIECE				P	V	V			
		iii) Accuracy Limit Test	B	T	1 PIECE	1 PIECE	1 PIECE				P	V	V			
		a) Visual & Dimension	B	VSL/I	100%	100%	100%				P	W	W			
		b) Routine Test														
		i) Verification of terminal marking and polarity	B	T(E)	100%	100%	100%				P	W	W			
		ii) Power Frequency Test on primary and secondary windings	A	T(E)	100%	100%	100%				P	W	W			
		iii) Over voltage inter-turn test	A	T(E)	100%	100%	100%	BHEL APPD DRG IS: 2705	BHEL APPD DRG IS: 2705	TC	P	W	W	GHP		
		iv) Determination of error according to requirement of appropriate accuracy class	A	T(E)	100%	100%	100%				P	W	W			
		v) Partial Discharge Measurement	A	T(E)	100%	100%	100%				P	W	W			
		vi) Current error, phase displacement & composite error	A	T(E)	100%	100%	100%				P	W	W			
vii) Knee point voltage & excitation current (For PS class	B	T(E)	100%	100%	100%				P	W	W					
viii) Turns Ratio	A	T(E)	100%	100%	100%	BHEL APPD DRG	BHEL APPD DRG	TC	P	W	W					

Rautindia

Q

BHARAT HEAVY ELECTRICALS LIMITED, RUDRAPUR														
BHEL/CFP/QC		QUALITY ASSURANCE PLAN FOR SUBMISSION CUSTOMER : M/s PUNATSANGCHHU-II HYDROELECTRIC PROJECT AUTHORITY, BHUTAN PROJECT: 6 X 170 MW PUNATSANGCHHU-II HYDROELECTRIC PROJECT IWO NO.: 0063-X-1 TO 13-0068-X-1			QUALITY ASSURANCE PLAN FOR ISOLATED PHASE BUS DUCT, LAVT & NG CUBICLE			MATERIAL INSPECTION / INPROCESS INSPECTION / FINAL INSPECTION		SUB-VENDORS / VENDORS / CONTRACTORS WORKS			DOC NO.: QP/BD/IP/PHAP II REV. NO.: 06 DATE: 21.10.2016	
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK (TYPE OF TEST)	QUANTUM OF CHECK			REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
					M	C	N				M	C	N	
2.8	Lightning Arrester	*c) Type Test												
		i) Temp. Rise Test	B	T(E)	1 PIECE	1 PIECE	1 PIECE	IS: 2705	IS: 2705		P	V	V	
		ii) Impulse Test	B	T(E)	1 PIECE	1 PIECE	1 PIECE				P	V	V	
		a) Visual & Dimension	B	I	100%	100%	100%				P	W	W	
		b) Creepage distance	B	I	100%	100%	100%	BHEL APPD DRG	BHEL APPD DRG		P	W	W	
		c) Acceptance Tests												
2.9	Surge Capacitor	i) PF ref. voltage test	A	T	100%	100%	100%	IEC-99.4	IEC-99.4		P	W	W	CHP
		ii) Lightning impulse Residual voltage test	A	T(E)	100%	100%	100%	IS: 3070	IS: 3070	TC	P	W	W	
		iii) Seal leakage test	A	T(E)	100%	100%	100%				P	W	W	
		iv) Partial discharge test	A	T(E)	100%	100%	100%				P	W	W	
		*d) Type Tests												
		i) Partial discharge test	B	T	1 PIECE	1 PIECE	1 PIECE				P	V	V	
2.9	Surge Capacitor	ii) Insulation withstand test	B	T(E)	1 PIECE	1 PIECE	1 PIECE				P	V	V	CHP
		iii) Long duration current Impulse withstand test	B	T(E)	1 PIECE	1 PIECE	1 PIECE				P	V	V	
		iv) Operation duty test	B	T(E)	1 PIECE	1 PIECE	1 PIECE				P	V	V	
		a) Dimension	B	I	100%	100%	100%				P	W	W	
		b) Acceptance Test												
		i) Measurement of capacitance	A	T(E)	100%	100%	100%				P	W	W	
		ii) Dielectric loss angle	A	T(E)	100%	100%	100%				P	W	W	
		iii) Capacitor loss test	A	T(E)	100%	100%	100%				P	W	W	
		iv) DC voltage between terminals	A	T(E)	100%	100%	100%				P	W	W	
		v) Efficacy of discharge device	A	T(E)	100%	100%	100%	BHEL APPD DWG	BHEL APPD DWG		P	W	W	
		vi) Sealing test	A	T	100%	100%	100%	IS: 11548/IS 13925	IS: 11548/IS 13925	TC	P	W	W	
		*c) Type Test												
		i) Impulse Test	B	T(E)	1 PIECE	1 PIECE	1 PIECE				P	V	V	
		ii) Measurement of capacitance	B	T(E)	1 PIECE	1 PIECE	1 PIECE				P	V	V	
		iii) Thermal stability test	B	T(E)	1 PIECE	1 PIECE	1 PIECE				P	V	V	
iv) Short circuit discharge test	B	T(E)	1 PIECE	1 PIECE	1 PIECE				P	V	V			
v) Partial discharge test	B	T(E)	1 PIECE	1 PIECE	1 PIECE				P	V	V			

Rawndia



BHARAT HEAVY ELECTRICALS LIMITED, RUDRAPUR

BHEL/CFP/QC

QUALITY ASSURANCE PLAN FOR SUBMISSION
 CUSTOMER : M/s PUNATSANGCHHU-II
 HYDROELECTRIC PROJECT AUTHORITY, BHUTAN
PROJECT: 6 X 170 MW PUNATSANGCHHU-II
 HYDROELECTRIC PROJECT
IWO NO.: 0063-X-1 TO 13-0068-X-1

**QUALITY ASSURANCE PLAN FOR ISOLATED
 PHASE BUS DUCT, LAVT & NG CUBICLE**

**MATERIAL INSPECTION / INPROCESS
 INSPECTION / FINAL INSPECTION**

**SUB-VENDORS /
 VENDORS /
 CONTRACTORS WORKS**

DOC NO.: QP/BD/IP/PHAP-II
REV. NO.: 06
DATE: 21.10.2016

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK (TYPE OF TEST)	QUANTUM OF CHECK			REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS				
					M	C	N				M	C	N					
2.10	Hot Air Blowing Equipment	a) Visual/Dimension	B	VSL/I	100%	100%	100%	BHEL APPD DWG IS: 325 IS: 11989	BHEL APPD DWG IS: 325 IS: 11989	TC	P	W	V	TC SHALL BE SUBMITTED TO PHPA-II FOR REVIEW				
		b) Routine Test	B	T	100%	100%	100%				P	W	V					
		i) Performance test quality of air delivered and discharge pressure	B	T	100%	100%	100%				P	W	V					
		ii) Temperature rise at outlet air	B	T	100%	100%	100%				P	W	V					
2.11	Steel Support Structure	iii) Internal function	B	T(E&M)	100%	100%	100%	1 PIECE	1 PIECE	1 PIECE	P	W	V					
		a) Raw material (Mechanical Tests, Chemical	B	T	1 PIECE	1 PIECE	1 PIECE				P	W	V					
		composition)	B	T	1 PC/LOT	1 PC/LOT	1 PC/LOT				BHEL DWG IS: 2629 IS: 2633	BHEL DWG IS: 2629 IS: 2633	TC		P	W	V	TC SHALL BE SUBMITTED TO PHPA-II FOR REVIEW
		b) Dimension	B	T	1 PC/LOT	1 PC/LOT	1 PC/LOT								P	W	V	
c) Galvanizing	B	T	1 PC/LOT	1 PC/LOT	1 PC/LOT	P	W	V										
2.12	H.T. Fuse	ii) Adhesion Test	B	T	1 PC/LOT	1 PC/LOT	1 PC/LOT	1 PC/LOT	1 PC/LOT	1 PC/LOT	P	W	V	TC SHALL BE SUBMITTED TO PHPA-II FOR REVIEW				
		iii) Uniformity of zinc coating	B	T	1 PC/LOT	1 PC/LOT	1 PC/LOT				P	W	V					
		a) Measurement of resistance	B	T	100%	10%	10%				IEC-60282-1	IEC-60282-1	TC		P	W	V	
			B	I	3 PC/LOT	3 PC/LOT	3 PC/LOT				BHEL DWG SPEC.	BHEL DWG SPEC.	TC		P	V	-	
b) Class / grade	B	I	3 PC/LOT	3 PC/LOT	3 PC/LOT	P	V	-										
3 3.1	FABRICATION Enclosure & Conductor Fabrication	a) Dimension	B	T	100%	100%	10%	BHEL DWG BS-159	BHEL DWG ±20 variation in resistance of plain to welded cond.	OS/TC	P	W	V	TC SHALL BE SUBMITTED TO PHPA-II FOR REVIEW				
		b) DP test on Weld	A	I	100%	100%	10%				P	W	V					
		c) mV drop test on straight butt joint on conductor	A	I	1 PC/LOT	1 PC/LOT	1 PC/LOT				P	W	V					
		d) Silver plating on palm (if required)	B	T	10%	100%	10%				P	W	V					

Ramdas

[Signature]



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					M	C	N				M	C	N	
3.2	Disconnecting links, shorting links / bar	a) Visual b) Dimension c) Conductivity d) Mechanical Test	B B A B	VSL I T T	100% 100% 1 PC/LOT 1 PC/LOT	100% 100% 1 PC/LOT 1 PC/LOT	10% 10% 1 PC/LOT 1 PC/LOT	BHEL DWG	BHEL DWG	OS/TC	P P P P	V V V V	V V V V	TC SHALL BE SUBMITTED TO PHPA-II FOR REVIEW
4	ASSEMBLY													
4.1	Enclosure & Conductor Assembly	a) Dimension b) Distance between Insulator c) Painting thickness & Adhesion Test	A A A	I I T	100% 100% 100%	100% 100% 100%	10% 10% 10%	BHEL DWG APPROVED LAYOUT	BHEL DWG APPROVED LAYOUT	OS	P P P	W W W	W W W	CHP
4.2	SAVT & NG Cubicle Assembly	a) Dimension b) Raw material of sheet (chemical, mechanical tests) c) Wiring	A B	I T	100% 1 PC/LOT	100% 1 PC/LOT	100% 1 PC/LOT	BHEL DWG APPROVED LAYOUT	BHEL DWG APPROVED LAYOUT	OS/TC	P P	W V	W V	CHP
5	FINAL TESTING ON BUSDUCT													
5.1	Routine Test	i) Visual ii) Continuity iii) 2 KV Test d) HV Test e) Paint thickness & adhesion *f) Degree of protection g) Verification of BOM a) Dimension b) Finish c) Marking d) Power frequency/ HV with stand test for 1 min e) IR	A A B B B B B B B A A	T(VSL/E) T T T(M) VSL I VSL VSL T(E) T(E)	100% 100% 100% RANDOM 1 PIECE 100% 100% 100% 100% 100% 100%	100% 100% RANDOM RANDOM 1 PIECE 100% 100% 100% 100% 100%	100% 100% RANDOM RANDOM 1 PIECE 100% 100% 100% 100%	IS: 8084	IS: 8084	TC	P P P P P P P P P P	W W W W V W W W W W	W W W W V W W W W W	CHP

Rawindra

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					M	C	N				M	C	N	
5.2	Type test on Main, Delta & Tap-off Bus Duct.	*a) Short time current test *b) Temperature rise test c) Power frequency voltage *d) Impulse voltage test	A A A A	T(E) T(E) T(E) T(E)	1 PIECE 1 PIECE 1 PIECE 1 PIECE	1 PIECE 1 PIECE 1 PIECE 1 PIECE	1 PIECE 1 PIECE 1 PIECE 1 PIECE	IS: 8084	IS: 8084	TC	P P P P	W W W W	V V W V	CHP
5.3	Special tests	a) Water tightness b) Air tightness	A A	T(M) T(M)	1 PIECE 1 PIECE	1 PIECE 1 PIECE	1 PIECE 1 PIECE	IS: 8084	IS: 8084		P P	W W	W W	CHP
NOTE:		FOR ALL THE " * " MARKED TESTS, SIMILAR TYPE TEST REPORTS SHALL BE SUBMITTED FOR REVIEW.												

LEGEND: -

CLASS

A: CRITICAL
B: MAJOR
C: MINOR

TYPE OF CHECK

VSL: VISUAL
I: MEASUREMENT
T: TEST
E: ELECTRICAL
M: MECHANICAL

AGENCY

M: MANUFACTURER /SUB CONTRACTOR
C: BHEL/NOMINATED INSPECTION AGENCY
N: CUSTOMER (PHPA-II)

SCOPE

P: PERFORMER
V: REVIEW OF TC
W: WITNESS
CHP: CUSTOMER HOLD POINT

FORMAT OF RECORD

TC: TEST CERTIFICATE
OS: OBSERVATION SHEET
Drg.: DRAWING
Ch.List: CHECK LIST

Ravindra

PREPARED & CHECKED BY

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APPROVED BY

ANNEXURE FOR TYPE TESTS BUS DUCTS

Sl. No.	Type test report no.	Report Test date	Equipment	Type test	PHPA-II rating requirement	Rating achieved in type test report	Remarks
1	2013/STL/300	27/02/2013	Main IPBD	Temp. Rise test	10000A CURRENT	11000A CURRENT	In line with MOM comments , Fresh report is been submitted for approval to PHPA-II vide Letter 037 dated 29.08.2016
2	HPL12189	11/10/1012	Main IPBD	Short time current	96KArms FOR 1 SEC, 229.5KApeak	254KArms FOR 1 SEC, 647.7 KApeak	Qualifying the project requirement. CEA/WAPCOS/PHPA-II agreed and accepted
3	43/1/2013- HV/0734/BHEL	01-04-2013	Main IPBD	IMPUSLE TEST	125KV PEAK	125KV PEAK	Qualifying the project requirement. CEA/WAPCOS/PHPA-II agreed and accepted
4	2016/STL/843	27/07/2016	DELTA IPBD	Temp. Rise test	6300A CURRENT	6300A CURRENT	Report submitted for approval to PHPA-II vide letter 037 dated 29.08.2016.
5	2014-STN-1-061	13/03/2014	DELTA IPBD	Short time current	96KArms FOR 1 SEC, 229.5KApeak	97.49KArms FOR 1 SEC, 241.5KApeak	Qualifying the project requirement. CEA/WAPCOS/PHPA-II agreed and accepted
6	2006/STL/1450	15/11/2012	DELTA IPBD	IMPUSLE TEST	125KV PEAK	125KV PEAK	Qualifying the project requirement. CEA/WAPCOS/PHPA-II agreed and accepted
7	2015/STL/1444	27/10/2015	TAPOFF IPBD	Temp. Rise test	250A	250A	Qualifying the project requirement. CEA/WAPCOS/PHPA-II agreed and accepted
8	HPL16021	20/01/2016	TAPOFF IPBD	Short time current	162KArms FOR 1 SEC, 428.4KApeak	169.1KArms FOR 1 SEC, 432.5 KApeak	Qualifying the project requirement. CEA/WAPCOS/PHPA-II agreed and accepted
9	2015/STL/1604	12-02-2015	TAPOFF IPBD	IMPUSLE TEST	125KV PEAK	125KV PEAK	Qualifying the project requirement. CEA/WAPCOS/PHPA-II agreed and accepted
10			Main IPBD	AIR AND WATER TIGHTNESS TEST			THESE TYPE TESTS WILL BE CONDUCTED AT BHEL RUDRAPUR WORKS DURING BUS DUCT INSPECTION.
11			DELTA IPBD	AIR AND WATER TIGHTNESS TEST			
12			TAPOFF IPBD	AIR AND WATER TIGHTNESS TEST			
13			Main IPBD	Power frequency voltage test			THESE TYPE TESTS WILL BE CONDUCTED AT BHEL RUDRAPUR DURING BUS DUCT INSPECTION.
14			DELTA IPBD	Power frequency voltage test			
15			TAPOFF IPBD	Power frequency voltage test			

Accepted in MOM dt.09-12/08/16

Re submitted Reports on 29/08/16