

SECTION D6-1

SEGREGATED AND NON SEGREGATED PHASE BUSDUCTS

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION:D6-1
PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS Stage- V, Unit # 7 & 8 at Suratgarh, Rajasthan SEGREGATED & NON-SEGREGATED PHASE BUSDUCT	SHEET 1 OF 3
1.0 <u>SEGREGATED PHASE BUS DUCTS (SPBD)</u> 1.1 Segregated phase bus duct and accessories shall be provided for connection of - Unit transformers and station transformers to respective 11kV switchgears. - Ties between 11kV Unit Switchgears-7A/7B/8A/8B to 11kV Station Switchgears- 8C/8D/7C/7D respectively. - Ties between 11kV Station switchgears-7C/7D to 11kV Station Switchgears-8C/8D. - SPBD shall be provided on LV side of all 11kV/6.9kV transformers 1.2 The continuous rating of the bus duct from UTs to respective unit switchgear and tie between Unit and Station switchgears shall be same as the rated current of 11 kV unit switchgear bus. 1.3 The continuous rating of the bus duct from STs to respective station switchgear and ties between Station switchgears shall be same as the rated current of 11 kV station switchgear bus. 1.4 The continuous rating of the bus duct from unit auxiliary transformer to unit auxiliary switchgear shall be same as the rated current of 6.6kV unit auxiliary switchgear bus. Same is applicable for SPBD for Station auxiliary Transformer and Raw water Transformer. 1.5 The short time and momentary current ratings of the bus ducts shall be same as that of associated 11 kV and 6.6kV switchgear. 2.0 <u>NON-SEGREGATED PHASE BUS DUCTS [NSPBD]</u> 2.1 1.1 kV class non-segregated phase bus duct and accessories shall be provided for connection between all service transformers and their respective 415V switchgear. NSPBD shall also be considered for connections between other switchgear / MCCs to suit the layout. 2.2 The continuous rating of the bus duct shall be same as the rated current of respective switchgear bus. 2.3 The short time and momentary current ratings of the bus ducts shall be same as that of associated 415V switchgear. 2.4 The busbars in the bus-duct shall be sleeved with FRLS heat shrinkable, colour coded XLPE sleeves. 3.0 <u>SPECIFIC REQUIREMENTS</u> 3.1 The bus conductor shall be of Aluminium alloy grade 63401 as per IS: 5082. 3.2 The enclosure shall be rectangular and shall be made of aluminium alloy sheets for SPBD. Enclosure for NSPBD shall be of mild steel for current rating less than or equal to 1600A and aluminium alloy for greater than 1600A bus.		
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3.3 In case of segregated phase busduct, the phase segregation shall be of either aluminium or non-hygroscopic insulating material like fibreglass. 3.4 Flexible expansion joints shall be provided for the conductor and enclosure along the run of the bus duct length to take care of expansion. Also flexible joints shall be provided at the termination points. 3.5 Inspection covers for periodic inspection of the insulators shall be provided. There shall be no joints or fixing bolts on top of the enclosure through which water can seep. 3.6 The outdoor portion (at bolted joints of the bus duct shall be provided with a continuous rain hood of non-magnetic material suitably supported from the bus duct support structure. 3.7 The bus conductors shall be given a coat of matt black paint to facilitate heat dissipation. However the sizing of the bus conductor shall consider the conductor as unpainted. 3.8 The adjacent sections of the bus conductor shall be welded or bolted. 3.9 The joints along the conductors shall be of highest quality and the temperature rise test shall be conducted including the joints. 3.10 The bus support insulators shall be of 12kV/7.2kV class (as required) for segregated phase bus ducts and 1.1 kV class for non-segregated phase bus ducts and shall be mounted on resilient pads. 3.11 The material of insulator shall be epoxy resin cast. 3.12 The spacing of the bus support insulators shall be considered by giving due factor of safety to withstand the forces due to the momentary short circuit current assigned for the bus duct. 3.13 Wall frame assembly and seal off bushings shall be provided for SPBD where the bus duct passes through walls (indoor to indoor). These shall be fabricated out of aluminium angles and sheets. 3.14 Wall frame assembly and FRP sealing plate shall be provided for NSPBD where the bus duct passes through walls (indoor to indoor). 3.15 The bus duct supports shall be fabricated from standard steel sections. The support structures shall be hot dip galvanised. 3.16 Thermostatically controlled space heaters shall be provided along the run of bus duct. 3.17 Silicagel breathers shall be provided both in indoor and outdoor portions of bus duct for absorption of moisture. 3.18 All the routine and the following special tests shall be conducted on SPBD/NSPBD. (a) Air tightness test (b) Water tightness test		
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(c) Temperature rise test

3.19 Routine tests shall be conducted on all the pieces of SPBD & NSPBD as applicable. Also, test certificates shall be furnished for bought out items. Valid type test certificate shall be submitted. In case valid certificate is not available than type test shall be conducted on SPDB/NSPBD.

3.20 HV voltage test, air tightness test and water tightness tests shall be conducted at site on fully assembled bus duct.

4.0 TECHNICAL REQUIREMENTS

4.1 Segregated/non-segregated phase bus ducts shall comply with the particulars indicated in the following table.

Sl. No.	Description	Requirement for	
		Segregated Phase Bus duct	Non-segregated Phase Bus duct
(a)	Type of cooling	Natural air	Natural air
(b)	Maximum temperature rise of conductor over 50°C ambient	40°C	40°C
(c)	Maximum temperature rise of enclosure over 50°C ambient	20°C	20°C

5.0 DATA TO BE FURNISHED WITH THE BID

5.1 Technical particulars for the segregated/non-segregated phase bus ducts as per Table below

5.2 Experience list of the make of bus duct proposed

6.0 For technical particulars refer datasheet-A.

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		DATA SHEET-A SEGREGATED & NON-SEGREGATED PHASE BUSDUCT			

		SEGREGATED PHASE BUS DUCT		NON SEGREGATED PHASE BUS DUCT
		11 kV	6.6 kV	415V
1.0	<u>DESIGN PARTICULARS</u>			
1.1.	Type of Bus Duct	Phase segregated, Self cooled, Rectangular, Totally enclosed		Non-segregated, Self cooled, Rectangular, Totally enclosed
1.2.	Type of Cooling	Natural Air cooled		Natural Air cooled
1.3.	Installation Indoor/Outdoor	Indoor & Outdoor		Indoor & Outdoor
1.4.	Nominal Service Voltage - kV	11 kV	6.6 kV	415V
1.5.	Rated Voltage Class - kV	12 kV	7.2 kV	1.1kV
1.6.	Continuous Current Rating of Bus Ducts under Site Conditions - Amps	*		*
1.7.	Basic Impulse Insulation Level (1.2 x 50 micro second wave) - kV (Peak)	75	60	-
1.8.	One minute Power Frequency Withstand Voltage - kV (Peak)	28	20	3
1.9.	Momentary Current Rating - kA (Peak)	102	102	105
1.10.	Short Time Current Rating - kA (RMS)	Same as 11 kV switchgear	Same as 6.6 kV switchgear	Same as 415V switchgear
1.11.	Design maximum Temperature (Hot Spot) of Busbars at Rated Current - °C	40°C		40°C
1.12.	Design maximum Temperature (Hot Spot) of Enclosure at Rated Current - °C	20°C		20°C

REV. NO.	R0	R1	JOB NO. TCE - 5750A	CLIENT : RRVUNL
PPD. BY :	UM	SK		
CKD. BY :	MSVM	MSVM		PROJECT : 2 x 660 MW, Super-Critical TPS Stage- V, Unit # 7 & 8 at Suratgarh, Rajasthan
DATE	NOV'2009	JUN'2012		

SPEC. NO. TCE.5750A-H-500-001		TATA CONSULTING ENGINEERS LIMITED		VOLUME IV SECTION: D6-1	
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		DATA SHEET-A SEGREGATED & NON-SEGREGATED PHASE BUSDUCT			
		SEGREGATED PHASE BUS DUCT		NON SEGREGATED PHASE BUS DUCT	
		11 kV	6.6 kV	415V	
1.13.	Busbar Material	Aluminium alloy grade 63401 as per IS: 5082 or equivalent IEC/IEEE standard.		Aluminium alloy grade 63401 as per IS: 5082 or equivalent IEC/IEEE standard.	
1.14.	Busbar Section	Rectangular		Rectangular	
1.15.	Bus Enclosure Material	Aluminium alloy		Mild steel for current rating less than or equal to 1600A, Aluminium alloy for current ratings greater than 1600A.	
1.16.	Shape of Enclosure	Rectangular		Rectangular	
1.17.	Material of Phase Barriers	*		*	
1.18.	Phase Clearance (Minimum) - Phase to Phase mm - Phase to Earth mm	130 80	90 70	25 20	
1.19.	Type of Joints between Adjacent Sections of Bus Conductor Welded/Bolted	Bolted		Bolted	
2.0	<u>INSULATORS AND SEAL OFF BUSHINGS</u>				
2.1.	Rated Voltage kV(rms)	12	6.6	1.1	
2.2.	One minute Power Frequency Withstand Voltage				
	Dry kV (rms) Wet kV (rms)	35 35	27 27	3 -	
2.3.	Impulse Withstand Voltage (1.2 x 50 micro-second Wave) - kV	75	60	-	
2.4.	Minimum Creepage Distance	31mm/kV		31mm/kV	
REV. NO.	R0	R1	JOB NO. TCE - 5750A CLIENT : RRVUNL PROJECT : 2 x 660 MW, Super-Critical TPS Stage- V, Unit # 7 & 8 at Suratgarh, Rajasthan		
PPD. BY :	UM	SK			
CKD. BY :	MSVM	MSVM			
DATE	NOV'2009	JUN'2012			

SPEC. NO. TCE.5750A-H-500-001		TATA CONSULTING ENGINEERS LIMITED		VOLUME IV SECTION: D6-1	
PART B		RRVUNL, 2 x 660 MW, Super-Critical TPS Stage- V, Unit # 7 & 8 at Suratgarh, Rajasthan DATA SHEET-A SEGREGATED & NON-SEGREGATED PHASE BUSDUCT			SHEET 3 OF 3
		SEGREGATED PHASE BUS DUCT		NON SEGREGATED PHASE BUS DUCT	
		11 kV	6.6 kV	415V	
2.5.	Material of Insulators	Epoxy Resin Cast		Epoxy Resin Cast	
2.6.	Current rating of Seal of Bushings - Amps	To suit bus rating		To suit bus rating	
2.7.	Material of Seal Off Bushings	Epoxy Resin Cast		FRP or Epoxy Resin Cast	
3.0	<u>GENERAL</u>				
3.1.	Earthing Conductor				
	Material Size	GS 65x10 mm		GS 75x12 mm	
3.2.	Finish of Bus Enclosure				
	Exterior	To match with other near by equipments		To match with other near by equipments	
	Interior	Matt paint of dark colour, preferably black		Matt paint of dark colour, preferably black	
*Data to be furnished by Vendor.					
REV. NO.	R0	R1	JOB NO. TCE - 5750A	CLIENT : RRVUNL	
PPD. BY :	UM	SK			
CKD. BY :	MSVM	MSVM			
DATE	NOV'2009	JUN'2012		PROJECT : 2 x 660 MW, Super-Critical TPS Stage- V, Unit # 7 & 8 at Suratgarh, Rajasthan	

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1.0	<u>BUS DUCT</u>		
1.1	Manufacturer/ Country		
1.2	Bus Conductor		
	(a) Busbar grade		
	(b) Shape of busbar		
	(c) Size of busbar	mm ²	
1.3	Barriers		
	(a) Thickness of phase barrier	mm	
1.4	Phase to phase spacing	mm	
1.5	Size of enclosure W x H or Diameter if circular	Mmxmm/ mm	
1.6	Resistance/metre/Phase at 20°C of conductor	Ohm	
1.7	Inductive reactance/metre/phase at 20°C	Ohm	
1.8	Capacitive reactance/metre/phase at 20°C	Ohm	
1.9	Heat loss in the bus duct at full rated current	Watts/ ph/ m	
1.10	Weight of 3-phase duct	Kg/metre	
1.11	Standard section length	m	
1.12	Minimum required clearances from the periphery of the bus duct		
	i) To structural steel work parallel to the	mm	

NOTES TO BIDDER

- ITEMS WHICH DEViate FROM THE SPECIFICATION SHOULD BE MARKED WITHIN ASTERISK (*) AND DETAILS TO BE GIVEN IN SCHEDULE OF DEVIATIONS.
- THIS DATA SHEET SHALL BE FILLED UP COMPLETELY AND A COPY SHALL BE ENCLOSED WITH EACH COPY OF THE BID.

SIGNATURE OF BIDDER & DATE

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	duct		
	ii) To structural steel work perpendicular to the duct	mm	
2.0	<u>INSULATORS</u>		
2.1	Manufacturer/ Country		
2.2	Type		
2.3	Cantilever strength		
	i) Upright	Kg.	
	ii) Underhung	Kg.	
2.4	Weight of each insulator	Kg.	
3.0	<u>SEAL OFF BUSHINGS</u>		
3.1	Manufacturer/ Country		
3.2	Type		
3.3	Mechanical Strength		
	i) Compression	Kg.	
	ii) Tension	Kg.	
3.4	Weight of each bushing	Kg.	
3.5	interval of the expansion joints for bus conductor and bellows for enclosure in the long run of the bus duct	Mtrs.	
4.0	<u>BUS DUCT LAYOUT</u>		

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4.1	Reference drawing no.		
4.2	Bus enclosure - Section		
5.0	<u>GENERAL</u>		
5.1	Technical specific requirements conform to Data Sheet-A		Yes/No
5.2	If any deviation in technical specific requirements, it is brought out separately in deviation schedule		Yes/No Reference of deviation schedule

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DATA TO BE FURNISHED BY BIDDER AFTER AWARD OF CONTRACT

- 1.0 **DRAWINGS**
The BIDDER shall furnish the following drawings for the bus duct after the placement of the order:
- 1.1 General arrangement and dimensioned layout of the bus duct installation showing the connections to equipment and tap-offs, if any. Arrangement of the bus, insulators etc. within the bus duct
- 1.2 Drawing showing the requirement of embedment's in PURCHASER'S floors, ceiling, walls etc. along with the forces and their directions
- 1.3 Structural drawings along with foundation details for the structure
- 1.4 Drawing showing the terminal connection between the bus duct and the equipment terminals
- 1.5 Details of Seal-off bushing and wall frame assembly
- 1.6 Details of bus duct bonding arrangement
- 1.7 Itemized bill of material for complete bus duct covering all the components and associated accessories
- 1.8 Details showing a typical bus duct joint between sections
- 1.9 Details of typical rigid and expansion connections

2.0 TEST CERTIFICATES

- 2.1 Type test certificates for all the tests specified for the factory built bus-duct assembly and the component parts shall be submitted by the BIDDER. Available type tests certificates for component parts shall be submitted.
- 2.2 Routine test certificates for all the test specified for factory built bus-duct assembly and of all the component parts factory built bus-duct assembly and of all the component parts shall be submitted by the BIDDER.
- 2.3 Equipment shall not be dispatched unless the test certificates are duly approved by the PURCHASER/ENGINEER.

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2.4

The specified number of copies of the compiled and approved test certificates shall be submitted to the PURCHASER.

3.0

INSTRUCTION MANUALS

The BIDDER shall furnish specified number of copies of the instruction manual which would contain detailed instructions for all operational and maintenance requirement. The manual shall be furnished at the time of despatch of the equipment and shall include the following aspects.

(a) Outline dimension drawings showing relevant cross-sectional views, earthing details and constructional features.
(b) Rated voltages, current and all other technical information which may be necessary for correct operation of the bus duct.
(c) Catalogue numbers of all the component parts liable to be replaced during the life of the bus duct and the all the component parts.
(d) Unpacking
(e) Handling at site
(f) Erection drawings with written assembly instructions
(g) Precommissioning tests
(h) Maintenance procedures
(i) Precautions to be taken during operation and maintenance work.

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