

<b>ABB</b>	<b>ABB India Ltd</b>			Document number 1HYG900036-6
Unit PGHV- GIS PASS	Created Dhruvi Shukia	Version AE	Document part 001	Document type INS
Status Released	Last change Anurag Pandit	06.07.2019		

## PROJECT SPECIFIC PARAMETERS

Client: M/S BHARAT HEAVY ELECTRICALS LIMITED

End Customer: UTTARAKHAND JAL VIDYUT NIGAM LIMITED (UJVNL)

Project: 220kV GIS for 2x60 MW VYASI HEP AT VYASI, DISTT. DEHRADUN, UTTARAKHAND

NOA No: 136/E & M DESIGN-I/Vy-EPC(6) (FOR SUPPLY) dated 15.04.2014 & 137/E & M DESIGN-I/Vy-EPC(6) (FOR SERVICES) dated 15.04.2014

BHEL PO No.: 278P182, dated 31.08.2018

BHEL Doc no.: TB-4-398-316-103

Supplier: ABB India Ltd

गौरव विग / GORAV VIG  
 बरिष्ठ अभियंता (टी.बी.ई.एच.) / Sr. Engineer (TBEM)  
 पारंपरिक व्यापार समूह / Transmission Business Group  
 भारत हेवी इलेक्ट्रिकल्स लिमिटेड  
 Bharat Heavy Electricals Limited  
 5th Floor, Tower-A, Advant Navis IT Business Park,  
 Plot No.-7, Sector-142, Expressway Noida-201305 (U.P.)

APPROVED

SANJAY JOSHI  
 Dy. General Manager (E&M Design-I)  
 UJVNL Limited, Ganga Bhawan  
 Yamuna Colony, Dehradun-248001

<b>ABB</b>	Document type INS	Version AE	Document part 001	Document number 1HYG900036-6
------------	----------------------	---------------	----------------------	---------------------------------

## TABLE OF CONTENTS

1.	DESCRIPTION:.....	3
2.	MAIN DESIGN RATINGS OF SWITCHGEAR .....	4
3.	ENVIRONMENTAL CONDITIONS .....	4
4.	COLORS & POSITION INDICATORS FOR OPERATING MECHANISMS .....	4
5.	PRESSURE RELIEF DEVICE (GIVEN VALUE) .....	5
6.	PROTECTION LEVEL (GIVEN VALUE) .....	5
7.	SYSTEM VOLTAGES .....	5
8.	CIRCUIT BREAKER .....	5
9.	CIRCUIT BREAKER OPERATING MECHANISM .....	6
10.	DISCONNECTOR .....	6
11.	EARTHING SWITCH .....	7
12.	DISCONNECTOR / EARTHING SWITCH OPERATING MECHANISM .....	7
13.	HIGH SPEED EARTHING SWITCH .....	7
14.	HIGH SPEED EARTHING SWITCH OPERATING MECHANISM .....	8
15.	VOLTAGE TRANSFORMER .....	8
16.	CURRENT TRANSFORMER .....	8
17.	SURGE ARRESTER .....	8
18.	ELECTRICAL DATA OF DRIVES .....	9
19.	CONTROL CABLES (GIS-LCP) .....	9
20.	SF6 GAS SYSTEM .....	9
21.	DENSITY MONITORS .....	10
22.	HISTORY .....	10

APPROVED

*Sanjay Joshi*  
**SANJAY JOSHI**  
 Dy. General Manager (E&M Design-I)  
 UJVN Limited, Ganga Bhawan  
 Yamuna Colony, Dehradun-248001

<b>ABB</b>	Document type INS	Version AE	Document part 001	Document number 1HYG900036-6
------------	----------------------	---------------	----------------------	---------------------------------

**1. DESCRIPTION:** (Rev AE)

6 Bays of Double Bus bar GIS-Switchgear ELK-14/245C

Connected to:

02 nos. of GT bays with SF6 to Oil Termination  
02 nos. of Line bays with SF6 to Air bushing  
01 nos. of ST bays with SF6 to Oil Termination  
01 nos. of Bus coupler bay  
01 nos. of Metering Bay

For each Bay one set of secondary cable for GIS-equipment to run from GIS to LCC.  
For each Bay one Local Control Cubicle.

- Each gas-compartment with 1 density monitor
- Each gas-compartment with pressure relief device with absorber and gas coupling.

  
**APPROVED**

**SANJAY JOSHI**  
Dy. General Manager (E&M Design-I)  
UJVN Limited, Ganga Bhawan  
Yamuna Colony, Dehradun-248001

<b>ABB</b>	Document type INS	Version AE	Document part 001	Document number 1HYG900036-6
------------	----------------------	---------------	----------------------	---------------------------------

## 2. MAIN DESIGN RATINGS OF SWITCHGEAR



NO	DIMENSION	UNIT	VALUE	REV
2.1	Type of GIS		ELK-14 / 245C	
2.2	Rated voltage $U_r$	kV	245	
2.3	Nominal system voltage $U_n$	kV	220	
2.4	Rated frequency $f_r$	Hz	50	
2.5	Rated normal current $I_r$ - Circuit Breaker - Busbar & Bus-Coupler - Exit to Cable	A	1600	
		A	1600	
		A	1600	
2.6	Rated short time withstand current $I_k$	kA	50	
2.7	Rated duration of short circuit $t_k$	s	1	
2.8	Rated peak withstand current $I_p$	kAp	100	
2.9	Rated lightning impulse withstand voltage (BIL) $U_p$ - Phase to earth - Across open contacts	kVp	1050	
		kVp	1200	
2.10	Rated switching impulse withstand voltage (SIL) $U_s$ - Phase to earth - Across open contacts	kV	Not Applicable	
		kV	Not Applicable	
2.11	Rated power frequency withstand voltage $U_d$ - Phase to earth - Across open contacts	kVrms	460	
		kVrms	530	

## 3. ENVIRONMENTAL CONDITIONS

NO	DIMENSION	UNIT	VALUE	REV	
3.1	Equipment location		Indoor / Outdoor		
3.2	Ambient temperature	- (min...max)	°C	0.3...42.8	AE
3.3	Altitude above sea level		m	535	
3.4	Distance to the sea		Km	1000	
3.5	Ice load (ice coating)		mm	NA	
3.6	Humidity		%	100%	
3.7	Wind Load		m/s	47	
3.8	Pollution level (IEC 60815, Table 1)		Class	Less Polluted	
3.9	Earthquake withstand ability	- horizontal	g	Zone IV as per IS 1893-year 2002 0.3	AE
		- vertical	g	0.2	

## 4. COLORS & POSITION INDICATORS FOR OPERATING MECHANISMS

NO	DIMENSION	VALUE	REV	
4.1	GIS enclosures	- Indoor	RAL7038 (Agate grey)	AE
		- Outdoor	RAL9016 (Traffic White)	
4.2	Bursting discs	- Indoor	RAL7005 (Mouse grey)	
		- Outdoor	RAL7005 (Mouse grey)	
4.3	Flange of barrier insulators		RAL 2004 (Pure orange)	
4.4	Local control Cubicles (LCC)		RAL7038 (Agate grey)	
4.5	Steel support structures		hot dip galvanised (HDG) $\geq 85 \mu\text{m}$	
4.6	Phase designation		R-Y-B	

4.7	Open position (Circuit Breaker, Disconnecter, Earthing Switches)	- background colour - letter colour	Green white		
	Closed position (Circuit Breaker, Disconnecter, Earthing Switches)	- background colour - letter colour	Red white		

*Sanjay*  
APPROVED

SANJAY JOSHI  
Dy. General Manager (E&M Design-I)  
UJVN Limited, Ganga Bhawan  
Yamuna Colony, Dehradun-248001

<b>ABB</b>	Document type INS	Version AE	Document part 001	Document number 1HYG900036-6
------------	----------------------	---------------	----------------------	---------------------------------

### 5. PRESSURE RELIEF DEVICE (GIVEN VALUE)

	PART OF INSTALLATION	UNIT	VALUE	REV
Rupture pressure at 20 °C	Circuit breaker	kPa	1150	
	Voltage Transformers	kPa	1300	
	Other gas compartments	kPa	1300 / 1150	AE

### 6. PROTECTION LEVEL (GIVEN VALUE)

	PART OF INSTALLATION	VALUE	REV
Protection level	Circuit breaker operating mechanism	IP54	
	Disconnecter / earthing switch operating mechanism assembled in drive box	IP43	
	Local control cubicle	IP43	

### 7. SYSTEM VOLTAGES

NO	DIMENSION	UNIT	VALUE	REV
7.1	Rated voltage for DC supplies	VDC	220	
7.2	Rated voltage for AC supplies - Phase to earth - Phase to phase	VAC	240	
		VAC	415	
7.3	Rated frequency	Hz	50	

### 8. CIRCUIT BREAKER

NO	DIMENSION	UNIT	VALUE	REV
8.1	Applicable standards	IEC	62271-100 62271-203	
		ANSI	C 37.09	
8.2	Type		Puffer type	
8.3	Designation		ELK-SP14	
8.4	Manufacturer		ABB	
8.5	Number of operating mechanisms per 3 phases		3	
8.6	Rated lightning impulse withstand voltage - phase to earth - across open contacts	kV	1050	
		kV	1200	
8.7	Rated switching impulse withstand voltage - phase to earth - across open contacts	kV	NA	
		kV		
8.8	Rated power frequency withstand voltage - phase to earth - across open contacts	kV	460	
		kV	530	
8.9	Number of breaks per pole		1	
8.10	Rated normal current	A	3150 (1600 A project specific)	
8.11	Rated short circuit breaking current	kA	50	
8.12	Rated making current	kA	100	
8.13	First pole to clear factor		1.3	
8.14	Rated operating sequence		O-0.3s-CO-3min-CO	
8.15	Rated operating times - Opening time - Breaking time - Closing time - Close-open time	ms	≤ 19	
		ms	≤ 39	
		ms	≤ 60	
		ms	≤ 30	
8.16	Rated cable charging breaking current	A	250	
8.17	Rated line charging breaking current	A	125	
8.18	Rated class	-	C2, M2	
8.19	Number of CO-operations before overhaul - At no load mechanical	CO	10000	

<b>ABB</b>	Document type INS	Version AE	Document part 001	Document number 1HYG900036-6
------------	----------------------	---------------	----------------------	---------------------------------

	-At rated Normal Current (3150 A)	CO	5000	
	- At rated short circuit current / 50 kA	CO	32	
8.20	Approx. volume of SF6 gas	dm <sup>3</sup>	370	
8.21	Approx. weight , without mechanism (per pole)	kg	347	

## 9. CIRCUIT BREAKER OPERATING MECHANISM

NO	DIMENSION	UNIT	VALUE	REV
9.1	Applicable standards	IEC ANSI	62271-100 62271-203 C 37.09	
9.2	Type		hydraulic - spring	
9.3	Designation		HMC-4	
9.4	Manufacturer		ABB	
9.5	Rated voltage	VDC	220	
9.6	Range of variation	%	85-110	
9.7	Pump motor current - Rated current - Starting current	A A	4 20	
9.8	Rated power	W	660	
9.9	Number of trip / close coils	Piece	2 / 1	
9.10	Nominal voltage of trip / close coils	VDC	220	
9.11	Range of variation - Close coil - Trip coil	% %	85 -110 70 -110	
9.12	Auxiliary switches : rated voltage	VDC	220	
9.13	Degree of protection (IEC 60144)		IP54	
9.14	Approx. weight.	kg	405	

## 10.DISCONNECTOR

NO	DIMENSION	UNIT	VALUE	REV
10.1	Applicable standards	IEC	62271-102, 62271-203	
10.2	Type		Motor operated	
10.3	Designation		BBM14 / TEM14	
10.4	Manufacturer		ABB	
10.5	Number of operating mechanisms per 3 phases		1	
10.6	Rated lightning impulse withstand voltage - phase to earth - across open contacts	kV kV	1050 1200	
10.7	Rated switching impulse withstand voltage - phase to earth - across open contacts	kV kV	NA	
10.8	Rated power frequency withstand voltage - phase to earth - across open contacts	kV kV	460 530	
10.9	Rated normal current	A	3150 (1600 A project specific)	
10.10	Bus transfer current switching	A	1600	
10.11	Bus transfer voltage	V	20	
10.12	Opening time (time until contact separation)	s	≤ 3.5	
10.13	Closing time (time until contact touch)	s	≤ 3.5	
10.14	Number of CO-operations before overhaul	CO	10000	
10.15	Approx. volume of SF6 gas	dm <sup>3</sup>	300 / 170	
10.16	Approx. weight	kg	443 / 301	

APPROVED

SANJAY JOSHI  
Dy. General Manager (E&M-Design-I)  
UJVNL Limited, Ganga Bhawan  
Yamuna Colony, Dehradun-248001

<b>ABB</b>	Document type INS	Version AE	Document part 001	Document number 1HYG900036-6
------------	----------------------	---------------	----------------------	---------------------------------

### 11. EARTHING SWITCH

NO	DIMENSION	UNIT	VALUE	REV
11.1	Applicable standards	IEC	62271-102, 62271-203	
11.2	Type		Motor operated	
11.3	Designation		EM14	
11.4	Manufacturer		ABB	
11.5	Number of operating mechanisms per 3 phases		1	
11.6	Electrical endurance class according IEC		Class E0	
11.7	Mechanical Endurance class as per IEC		Class M1	
11.8	Withstand voltage of insulation to earth (if applicable)	kV	10	
11.9	Operating time - Closing time - Opening time	s s	≤ 3.5 ≤ 3.5	
11.10	Approx. volume of SF6 gas	dm <sup>3</sup>	2.2	
11.11	Approx. weight (3-Ph)	kg	56.5	

### 12. DISCONNECTOR / EARTHING SWITCH OPERATING MECHANISM

NO	DIMENSION	UNIT	VALUE	REV
12.1	Applicable standards	IEC	62271-102, 62271-203	
12.2	Type		Electrical motor	
12.3	Designation		DHS	
12.4	Manufacturer		ABB	
12.5	Rated voltage	VDC	220	
12.6	Range of variation	%	85-110	
12.7	Motor current - Running current - Starting/peak current	A A	5.5 20	
12.8	Rated power	W	400	
12.9	Motor running time open / close	s	≤ 3.5	
12.10	Auxiliary switches : rated voltage	VDC	220	
12.11	Degree of protection (IEC 60144)		IP43	

### 13. HIGH SPEED EARTHING SWITCH

NO	DIMENSION	UNIT	VALUE	REV
13.1	Applicable standards	IEC	62271-102, 62271-203	
13.2	Type		fast closing (spring) slow opening (motor)	
13.3	Designation		ES0	
13.4	Manufacturer		ABB	
13.5	Number of operating mechanisms per 3 phases		1	
13.6	Rated short circuit making current (peak)	kA	100	
13.7	Rated induced inductive current	A	80	
13.8	Rated induced capacitive current	A	3	
13.9	Electrical endurance class according IEC		Class E1	
13.10	Number of CO-operations before overhaul (+ 20 °C)	CO	3000	
13.11	Number of C operation at rated short-circuit making current	C	2	
13.12	Withstand voltage of insulation to earth (if applicable)	kV	10	
13.13	Operating time - Closing time (From spring release to contact touch) - Opening time	ms s	50 1	
13.14	Approx. volume of SF6 gas	dm <sup>3</sup>	3	
13.15	Approx. weight	kg	3.15	

APPROVED

SANJAY JORSHI  
Dy. General Manager (E&M Design-I)  
UJVNL Limited, Ganga Bhawan  
Yamuna Colony, Dehradun-248001

<b>ABB</b>	Document type INS	Version AE	Document part 001	Document number 1HYG900036-6
------------	----------------------	---------------	----------------------	---------------------------------

#### 14. HIGH SPEED EARTHING SWITCH OPERATING MECHANISM

NO	DIMENSION	UNIT	VALUE	REV
14.1	Applicable standards	IEC	62271-102, 62271-203	
14.2	Type		fast closing (spring) slow opening (motor) 1 Motor , 3 Springs	
14.3	Designation		ES0	
14.4	Manufacturer		ABB	
14.5	Rated voltage	VDC	220	
14.6	Range of variation	%	85-110	
14.7	Motor current - Running current - Starting/peak current	A A	2 10	
14.8	Rated power	W	300	
14.9	Motor running time open / close	s	≤ 2	
14.10	Auxiliary switches : rated voltage	VDC	220	
14.11	Degree of protection (IEC 60144)		IP43	
14.12	Approx. weight	kg	94	

#### 15. VOLTAGE TRANSFORMER

NO	DIMENSION	UNIT	VALUE	REV
15.1	Applicable standards	IEC	60044-2, 62271-203	
15.2	Type		Inductive	
15.3	Designation		PI14	
15.4	Manufacturer		Pfiffner / Sieyuan	
15.5	Rated lightning impulse withstand voltage	kV	1050	
15.6	Rated switching impulse withstand voltage	kV	NA	
15.7	Rated power frequency voltage - Primary winding - Secondary winding	kV kV	460 3	
15.8	Ratings & accuracy		*)	
15.9	Rated voltage factor		1.2/cont, 1.5 / 30 s	
15.10	Approx. Volume of SF6 gas (3- Ph)	dm <sup>3</sup>	275	
15.11	Approx. Weight (3-Ph)	kg	790	

\*) For ratings and accuracy please refer to doc. 1HYG900036-1 (Single Line & Gas Diagram)

#### 16. CURRENT TRANSFORMER

NO	DIMENSION	UNIT	VALUE	REV
16.1	Applicable standards	IEC	60044-1, 62271-203	
16.2	Type		Inductive	
16.3	Designation		ELK-CN14	
16.4	Manufacturer		Narayan Powertech	
16.5	Number of cores		*)	
16.6	Rated lightning impulse withstand voltage	kV	1050	
16.7	Rated switching impulse withstand voltage	kV	NA	
16.8	Rated power frequency voltage	kV	460	
16.9	Rated current	A	*)	
16.10	Ratings & accuracy		*)	
16.11	Approx. volume of SF6 gas (1- Ph)	dm <sup>3</sup>	27.8 – 28.2	
16.12	Approx. weight (1- Ph)	kg	300	

\*) For ratings and accuracy please refer to doc. 1HYG900036-1 (Single Line & Gas Diagram)

<b>ABB</b>	Document type INS	Version AE	Document part 001	Document number 1HYG900036-6
------------	----------------------	---------------	----------------------	---------------------------------

## 17. SURGE ARRESTER (REV AE)

NO	DIMENSION	UNIT	VALUE	REV
17.1	Applicable standards	IEC	60099-4, 62271-203	
17.2	Type and Class		Zinc Oxide, Class 3	
17.3	Designation		ELK-AZ14	
17.4	Manufacturer		TOSHIBA	
17.5	Maximum Continuous Operating Voltage	kV	158	
17.6	NOMINAL DISCHARGE CURRENT	kA	1050	
17.7	PEAK RESIDUAL VOLTAGE OF SWITCHING IMPULSE (30/60 $\mu$ s) @ 1 kA	kV	382	
17.8	PEAK RESIDUAL VOLTAGE OF LIGHTNING IMPULSE (8/20 $\mu$ s) @ 10 kA	kV	476	
17.9	PEAK RESIDUAL VOLTAGE OF STEP WAVE IMPULSE (1/9 $\mu$ s) @ 5 kA	kV	483	

## 18. ELECTRICAL DATA OF DRIVES

NO	DIMENSION	UNIT	VALUE	REV
18.1	Circuit breaker drive	VDC	220	
	- Pump motor	VDC	220	
	- Control voltage	VDC	220	
	- Close coil	VDC	220	
	- Trip coil	VDC	220	
	- Anti-condensation heater	VAC	240	
18.2	Disconnecter, earthing switch, fast acting earthing switch drive	VDC	220	
	- Control voltage	VDC	220	
	- Anti-condensation heater (in the drive box and in the FAES drive)	VAC	240	
18.3	Range of variation	%	85 - 110	
18.4	Available auxiliary contacts (for protection and customer)			AE
	- Circuit breaker (with contact multiplication)	NO / NC	12/12	
	- Disconnector	NO / NC	6/6	
	- Earthing switch	NO / NC	4/4	
	- Fast acting earthing switch	NO / NC	4/4	

## 19. CONTROL CABLES (GIS-LCP)

NO	DIMENSION	UNIT	VALUE	REV
19.1	Cross sections			
	- Control	mm <sup>2</sup>	1.5	
	- Anti-condensation heater	mm <sup>2</sup>	1.5	
	- Voltage transformer	mm <sup>2</sup>	2.5	
	- Current transformer	mm <sup>2</sup>	2.5	
19.2	Insulation		Cross-linked Polyethylene XLPE	
19.3	Outer sheath		HFC Halogen free, copper braid	
19.4	Colour		Black	

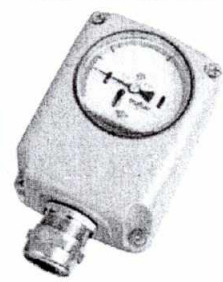
## 20. SF6 GAS SYSTEM

NO	DIMENSION	UNIT	VALUE	REV
20.1	Circuit breaker			
	- Filling pressure / density (at 20°C)	kPa <sub>abs</sub> / g/dm <sup>3</sup>	680 / 45.0	
	- Minimum functional pressure / density (at 20°C)	kPa <sub>abs</sub> / g/dm <sup>3</sup>	600 / 39.2	
	- Density monitor contact 1: SF6 gas falling	kPa <sub>abs</sub>	620	
	- Density monitor contact 2: CB trip block (trip circuit 2)	kPa <sub>abs</sub>	600	
	- Density monitor contact 3: CB trip block (trip circuit 1)	kPa <sub>abs</sub>	600	
20.2	Voltage transformer			
	- Filling pressure / density (at 20°C)	kPa <sub>abs</sub> / g/dm <sup>3</sup>	780 / 52.4	
	- Minimum functional pressure / density (at 20°C)	kPa <sub>abs</sub> / g/dm <sup>3</sup>	700 / 46.4	
	- Density monitor contact 1: SF6 gas falling	kPa <sub>abs</sub>	720	
	- Density monitor contact 2: SF6 gas low	kPa <sub>abs</sub>	700	
20.3	Other Gas zones (Bay and Outdoor Busducts)			
	- Filling pressure / density (at 20°C)	kPa <sub>abs</sub> / g/dm <sup>3</sup>	680 / 45.0	

<b>ABB</b>	Document type INS	Version AE	Document part 001	Document number 1HYG900036-6
------------	----------------------	---------------	----------------------	---------------------------------

	- Minimum functional pressure / density (at 20°C) - Density monitor contact 1: SF6 gas falling - Density monitor contact 2: SF6 gas low	kPa <sub>abs</sub> / g/dm <sup>3</sup> kPa <sub>abs</sub> kPa <sub>abs</sub>	600 / 39.2 620 600	AE
20.4	Other Gas zones (Indoor Busducts) - Filling pressure / density (at 20°C) - Minimum functional pressure / density (at 20°C) - Density monitor contact 1: SF6 gas falling - Density monitor contact 2: SF6 gas low	kPa <sub>abs</sub> / g/dm <sup>3</sup> kPa <sub>abs</sub> / g/dm <sup>3</sup> kPa <sub>abs</sub> kPa <sub>abs</sub>	530 / 34.3 450 / 28.7 470 450	AE

## 21.DENSITY MONITORS

NO	DIMENSION	VALUE	REV
21.1	Density monitor with display	Without scale	
21.2	Unit of pressure	kPa	
21.3	Type of display - 3 colour indication (green/yellow/red)		
21.4	Typical example of display;		

## 22.HISTORY

Date	Rev.	Changes
25.09.2018	AA	First issue
10.10.2018	AB	Modified as per customer comments
13.11.2018	AC	Modified as per Client comments. Included Equipment data
01.05.2018	AD	CT/VT cable size modified.
06.07.2019	AE	Modified as per latest SLGD (1HYG900036-1 Rev AE).

*Sanjay Joshi*  
APPROVED

SANJAY JOSHI  
Dy. General Manager (E&M Design-I)  
UJVN Limited, Ganga Bhawan  
Yamuna Colony, Dehradun-248001