








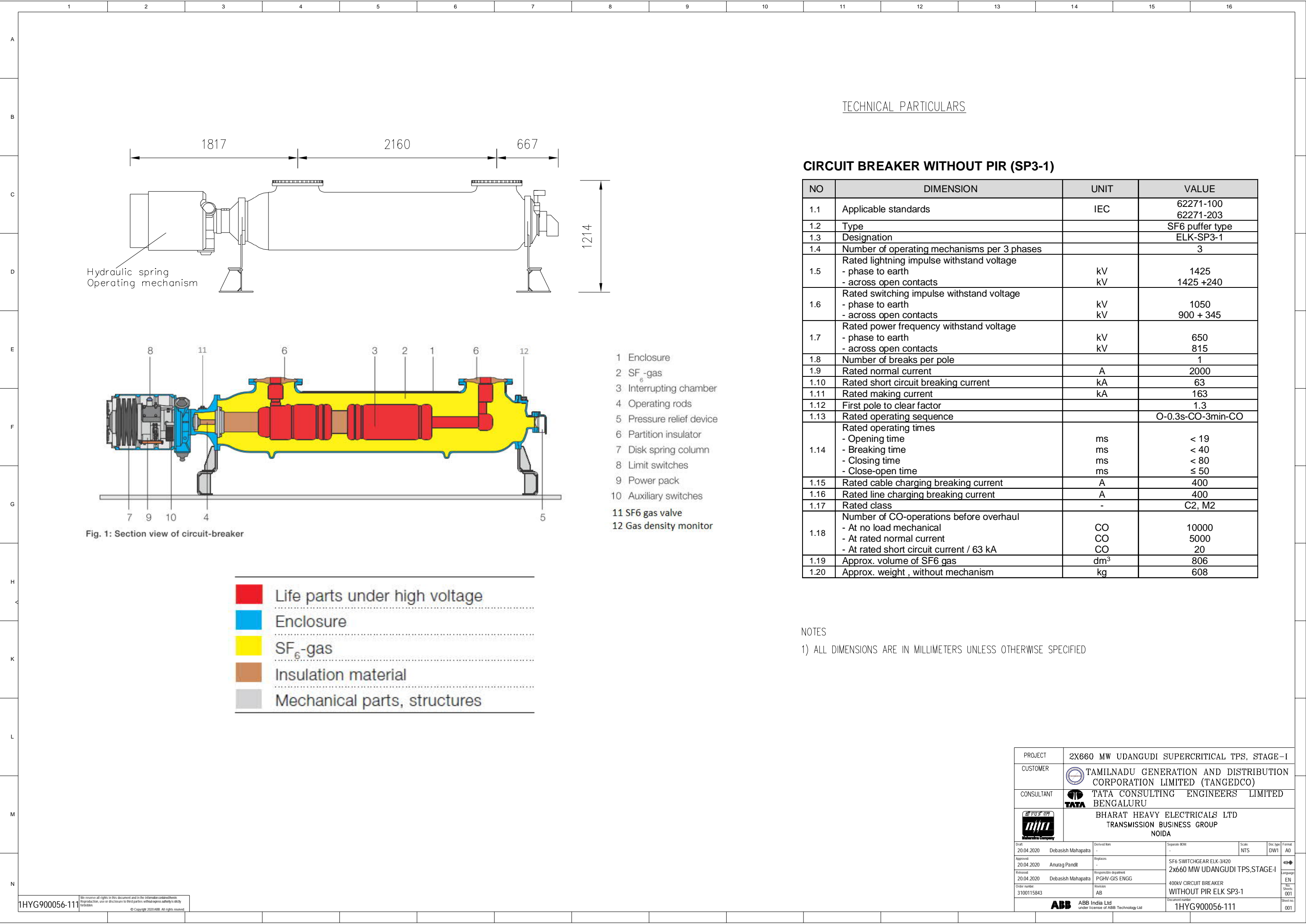


400kV GIS EQUIPMENT DRAWING

S. NO.	DOC ID	DOC TITLE	BHEL submission
1.	1HYG900056-111-REV AB	400kV CIRCUIT BREAKER WITHOUT PIR ELK SP3-1	01
2.	1HYG900056-112-REV AB	400kV CIRCUIT BREAKER WITHOUT PIR ELK SP3-PIR	01
3.	1HYG900056-113-REV AB	400kV DISCONN. & MANTAINANCE EARTHSWITCH ELK TK3	01
4.	1HYG900056-114-REV AB	400kV FAST ACTING EARTH SWITCH ELK EB3	01
5.	1HYG900056-115-REV AA	400KV VOLTAGE TRANSFORMER	00
6.	1HYG900056-116-REV AA	400KV CURRENT TRANSFORMER	00
7.	1HYG900056-117-REV AA	400KV ISOLATOR/SECTIONALISER	00

 TATA <small>TATA CONSULTING ENGINEERS LIMITED</small>		UDANGUDI SUPER CRITICAL THERMAL POWER PROJECT (2 X 660 MW)	
<input checked="" type="checkbox"/>	CAT-1	Drawing/documents approved for final distribution. BHEL will proceed with manufacturing/ fabrication/construction.	
<input type="checkbox"/>	CAT-2	Drawing/documents cleared for manufacturing/ fabrication/construction subject to incorporating the comments given. BHEL to resubmit the drawing for Approval in Category - 1. Comments will be marked on the drawing documents.	
<input type="checkbox"/>	CAT-4	Drawing document of this category are for information only and not for approval. Information furnished on the document is noted.	
<small>Approval conveyed herein neither relieves the Vendor/Contractor of his contractual obligations and his responsibilities for correctness of dimensions, materials of construction, weights, quantities, design details, assembly fits conforming to the relevant codes and standards as per the specification and performance requirements nor does it limit the purchaser's rights under the contract.</small>			
NOTE:			
1.	It is mandatory to close documents with Code 2 / 3 to Code 1 in agreed contract period or 2 weeks, whichever is earlier.		
2.	Any design changes / modification required to be carried out in Code 4 Drawings / Documents shall be the responsibility of BHEL. BHEL to resubmit reflecting the Design Changes for information.		
 <small>ENGINEER, TATA Consulting Engineers Ltd.</small> Date:		 <small>PROJECT MANAGER, TATA Consulting Engineers Ltd.</small> Date:	
		 <small>Chief Engineer/Projects-II CHIEF ENGINEER PROJECTS-II, TANGEDCO, CHENNAI-62</small> Date:	

Revised & new drawings submitted as per list above.		1	21.05.2020
First submission		0	28.02.2020
		REV	DATE
PROJECT	2X660 MW UDANGUDI SUPERCRITICAL TPS, STAGE-I		
CA NO.	CC-CS/651-SR2/HVDC-3063/7/G10/CA-I/5817-5821 date: 2017-01-25		
OWNER	TAMILNADU GENERATION AND DISTRIBUTION CORPORATION LIMITED (TANGEDCO)		
OWNER'S CONSULTANT	TATA CONSULTING ENGINEERS LIMITED BENGALURU		
CONTRACTOR	BHARAT HEAVY ELECTRICALS LIMITED		
SUPPLIER	ABB INDIA LIMITED		
DOC. ID.	TB-400-316-101-05 -REV 01		
NO. OF SHEETS ATTACHED	7		








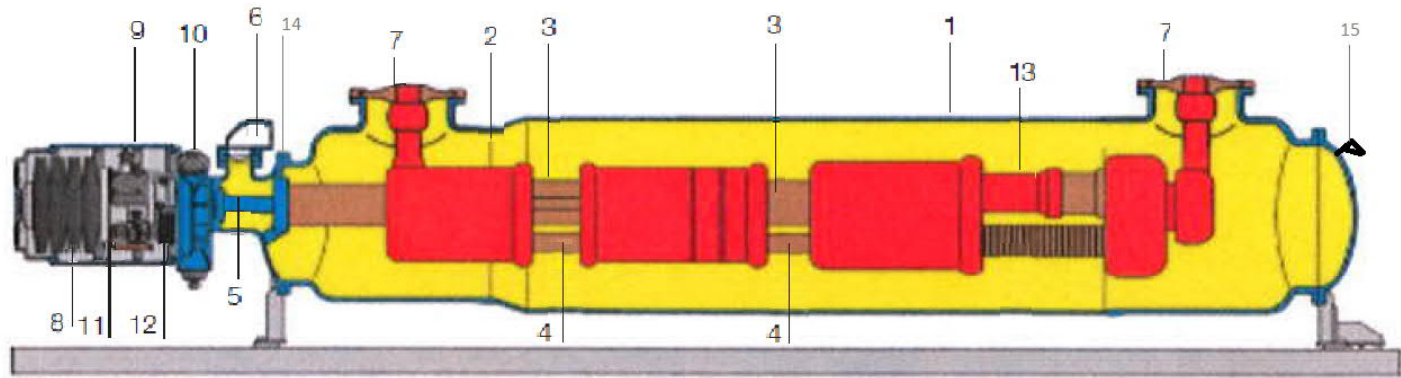
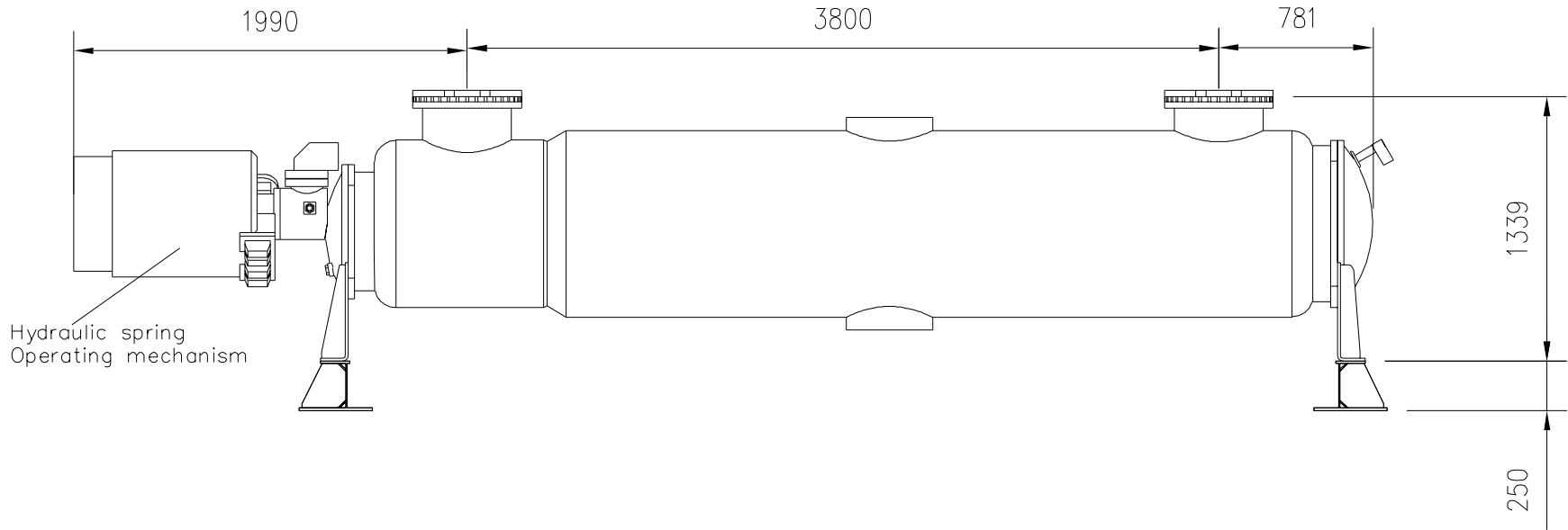
TECHNICAL PARTICULARS

CIRCUIT BREAKER WITHOUT PIR (SP3-1)

NO	DIMENSION	UNIT	VALUE
1.1	Applicable standards	IEC	62271-100 62271-203
1.2	Type		SF6 puffer type
1.3	Designation		ELK-SP3-1
1.4	Number of operating mechanisms per 3 phases		3
1.5	Rated lightning impulse withstand voltage - phase to earth - across open contacts	kV kV	1425 1425 +240
1.6	Rated switching impulse withstand voltage - phase to earth - across open contacts	kV kV	1050 900 + 345
1.7	Rated power frequency withstand voltage - phase to earth - across open contacts	kV kV	650 815
1.8	Number of breaks per pole		1
1.9	Rated normal current	A	2000
1.10	Rated short circuit breaking current	kA	63
1.11	Rated making current	kA	163
1.12	First pole to clear factor		1.3
1.13	Rated operating sequence		O-0.3s-CO-3min-CO
1.14	Rated operating times - Opening time - Breaking time - Closing time - Close-open time	ms ms ms ms	< 19 < 40 < 80 ≤ 50
1.15	Rated cable charging breaking current	A	400
1.16	Rated line charging breaking current	A	400
1.17	Rated class	-	C2, M2
1.18	Number of CO-operations before overhaul - At no load mechanical - At rated normal current - At rated short circuit current / 63 kA	CO CO CO	10000 5000 20
1.19	Approx. volume of SF6 gas	dm ³	806
1.20	Approx. weight , without mechanism	kg	608

NOTES
1) ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED

PROJECT	2X660 MW UDANGUDI SUPERCRITICAL TPS, STAGE-I				
CUSTOMER	 TAMILNADU GENERATION AND DISTRIBUTION CORPORATION LIMITED (TANGEDCO)				
CONSULTANT	 TATA CONSULTING ENGINEERS LIMITED BENGALURU				
 Bharat Heavy Electricals Company	BHARAT HEAVY ELECTRICALS LTD TRANSMISSION BUSINESS GROUP NOIDA				
Draft 20.04.2020 Debasish Mahapatra	Derived from -	Separate BOM -	Scale NTS	Doc. type DW1	Format A0
Approved 20.04.2020 Anurag Pandit	Replaces -	SF6 SWITCHGEAR ELK-3/420 2x660 MW UDANGUDI TPS, STAGE-I			 language EN Sheet no.: 001
Released 20.04.2020 Debasish Mahapatra	Responsible department PGHV-GIS ENGG	400kV CIRCUIT BREAKER WITHOUT PIR ELK SP3-1			
Order number: 3100115843	Revision AB	Document number: 1HYG900056-111			
 ABB India Ltd under license of ABB Technology Ltd					Sheet no. 001



- 1 Enclosure
- 2 SF6 - gas
- 3 Interrupting Chamber
- 4 Grading Capacitor
- 5 Operating rods
- 6 Pressure relief device
- 7 Partition insulator
- 8 Dis spring column
- 9 Limit switches
- 10 Position indicator
- 11 Power pack
- 12 Auxiliary switches
- 13 Pre insertion resistor
- 14 SF6 gas valve
- 15 Gas density monitor

- Life parts under high voltage
- Enclosure
- SF₆-gas
- Insulation material
- Mechanical parts, structures






TECHNICAL PARTICULARS

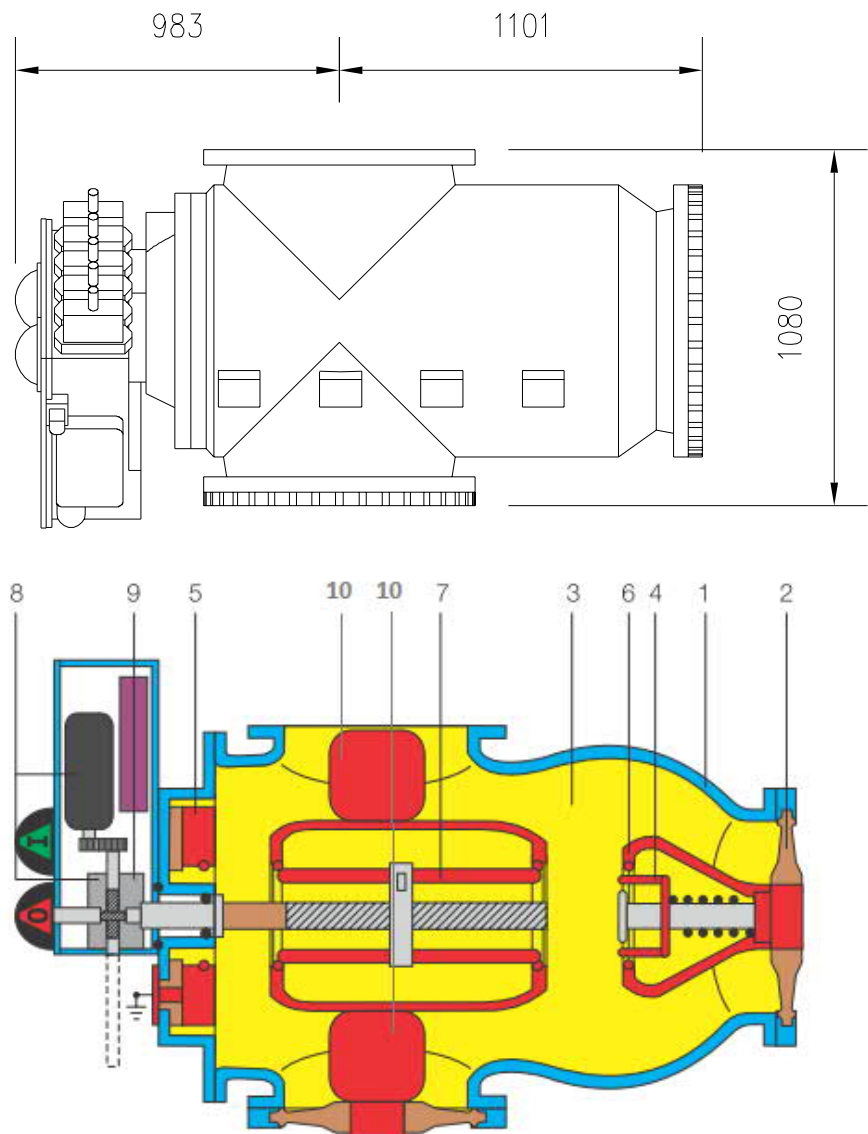
CIRCUIT BREAKER WITH CLOSING RESISTOR(SP3-PIR)

NO	DIMENSION	UNIT	VALUE
7.1	Applicable standards	IEC	62271-100 62271-203
7.2	Type		SF6 puffer type
7.3	Designation		ELK-SP3
7.4	Number of operating mechanisms per 3 phases		3
7.5	Rated lightning impulse withstand voltage - phase to earth - across open contacts	kV kV	1425 1425 +240
7.6	Rated switching impulse withstand voltage - phase to earth - across open contacts	kV kV	1050 900 + 345
7.7	Rated power frequency withstand voltage - phase to earth - across open contacts	kV kV	650 815
7.8	Number of breaks per pole		2
7.9	Rated normal current	A	2000
7.10	Rated short circuit breaking current	kA	63
7.11	Rated making current	kA	163
7.12	First pole to clear factor		1.3
7.13	Rated operating sequence		O-0.3s-CO-3min-CO
7.14	Rated operating times - Opening time - Breaking time - Closing time - Close-open time	ms ms ms ms	< 18 < 40 < 60 ≤ 40
7.15	Rated cable charging breaking current	A	400
7.16	Rated line charging breaking current	A	600
7.17	Rated single capacitor bank breaking current	A	400
7.18	Rated back to back capacitor bank breaking current	A	400
7.19	Rated class	-	C2, M2
7.20	Number of CO-operations before overhaul - At no load mechanical - At rated normal current - At rated short circuit current / 63 kA	CO CO CO	10000 5000 20
7.21	Circuit Breaker with CR resistance value of closing resistors	Ω	425 ± 10%
7.22	Circuit Breaker with CR pre-insertion time	ms	10 ± 2
7.23	Approx. volume of SF6 gas	dm ³	3250
7.24	Approx. weight , without mechanism	kg	1632

NOTES

1) ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED

PROJECT	2X660 MW UDANGUDI SUPERCRITICAL TPS, STAGE-I				
CUSTOMER	 TAMILNADU GENERATION AND DISTRIBUTION CORPORATION LIMITED (TANGEDCO)				
CONSULTANT	 TATA CONSULTING ENGINEERS LIMITED BENGALURU				
 Bharat Heavy Electricals Company	BHARAT HEAVY ELECTRICALS LTD TRANSMISSION BUSINESS GROUP NODA				
Draft 20.04.2020	Debasish Mahapatra	Derived from -	Separate BOM -	Scale NTS	Doc. type DW1
Approved 20.04.2020	Anurag Pandit	Replaces -	SF6 SWITCHGEAR ELK-3/420 2x660 MW UDANGUDI TPS,STAGE-I		
Released 20.04.2020	Debasish Mahapatra	Responsible department PGHV-GIS ENGG	400kV CIRCUIT BREAKER WITHOUT PIR ELK SP3-PIR		Language EN
Order number 3100115843	AB	Revision AB	Document number 1HYG900056-112		Sheet no. 001
 ABB India Ltd under license of ABB Technology Ltd					



- Legend**
- | | | |
|-------------------|----------------------------------|----------------------------------|
| 1 Encosulre | 5 Fixed contact for earthswitch | 8 Motor/gear |
| 2 Insulator | 6 Fixed contact for disconnecter | 9 Control unit/inter face module |
| 3 SF6-gas | 7 Moving contact | 10 Tulip contact |
| 4 Arching contact | | |

TECHNICAL PARTICULARS

6. DISCONNECTOR / EARTHING SWITCH

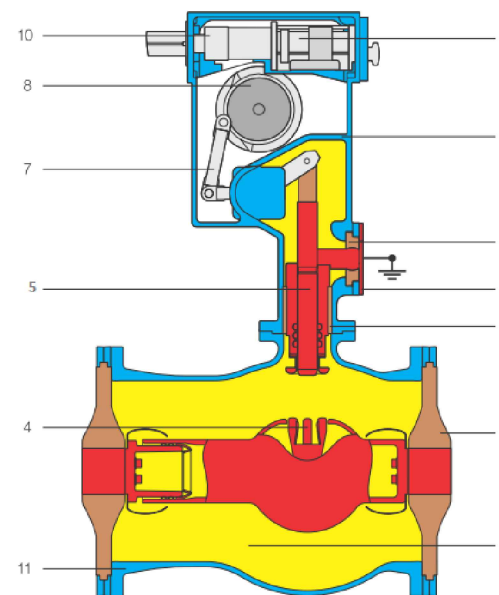
NO	DIMENSION	UNIT	VALUE
6.1	Applicable standards	IEC	62271-102, 62271-203
6.2	Type		Motor operated
6.3	Designation		ELK-TK3
6.4	Number of operating mechanisms per 3 phases		1
6.5	Rated lightning impulse withstand voltage - phase to earth - across open contacts	kV kV	1425 1425 +345
6.6	Rated switching impulse withstand voltage - phase to earth - across open contacts	kV kV	1050 1050 + 345
6.7	Rated power frequency withstand voltage - phase to earth - across open contacts	kV kV	650 815
6.8	Rated normal current (For Disconnecter)	A	4000
6.9	Rated normal current (For Earth switch)	A	100
6.10	Rated short time withstand current Ik	kA	63
6.11	Switching of bus charging current (capacitive current)	A	0.5
6.12	Bus transfer current switching	A	1600
6.13	Bus transfer voltage	V	20
6.14	Opening time (time until contact separation)	s	≤ 1
6.15	Closing time (time until contact touch)	s	≤ 2
6.16	Number of CO-operations before overhaul	CO	10000
6.17	Approx. volume of SF6 gas	dm ³	219
6.18	Approx. weight	kg	183

NOTES

1) ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED

- | | |
|--|-------------------------------|
| | Life parts under high voltage |
| | Enclosure |
| | SF ₆ -gas |
| | Insulation material |
| | Mechanical parts, structures |

PROJECT	2X660 MW UDANGUDI SUPERCRITICAL TPS, STAGE-I				
CUSTOMER	TAMILNADU GENERATION AND DISTRIBUTION CORPORATION LIMITED (TANGEDCO)				
CONSULTANT	TATA CONSULTING ENGINEERS LIMITED BENGALURU				
	BHARAT HEAVY ELECTRICALS LTD TRANSMISSION BUSINESS GROUP NOIDA				
Draft 20.04.2020	Debasish Mahapatra	Derived from -	Separate BOM -	Scale NTS	Doc. type DW1
Approved 20.04.2020	Anurag Pandit	Replaces -	SF6 SWITCHGEAR ELK-3/420 2x660 MW UDANGUDI TPS,STAGE-I 400kV DISCONN. & MAINTAINANCE EARTH SWITCH ELK TK3		
Released 20.04.2020	Debasish Mahapatra	Responsible department PGHV-GIS ENGG			
Order number 3100115843		Revision AB			
ABB India Ltd under license of ABB Technology Ltd			Document number 1HYG900056-113	Language EN	Sheet no. 001











- 1 Enclosure
- 2 Insulation/Insulator
- 3 SF₆-gas
- 4 Fixed contact
- 5 Moving contact
- 6 Earth connection (outside of SF₆-gas)
- 7 Gear
- 8 Spring-loaded assembly (outside of SF₆-gas)
- 9 Motor/gear
- 10 Rotating leverage to charge the spring-load
- 11 Connecting element

8. HIGH SPEED EARTHING SWITCH

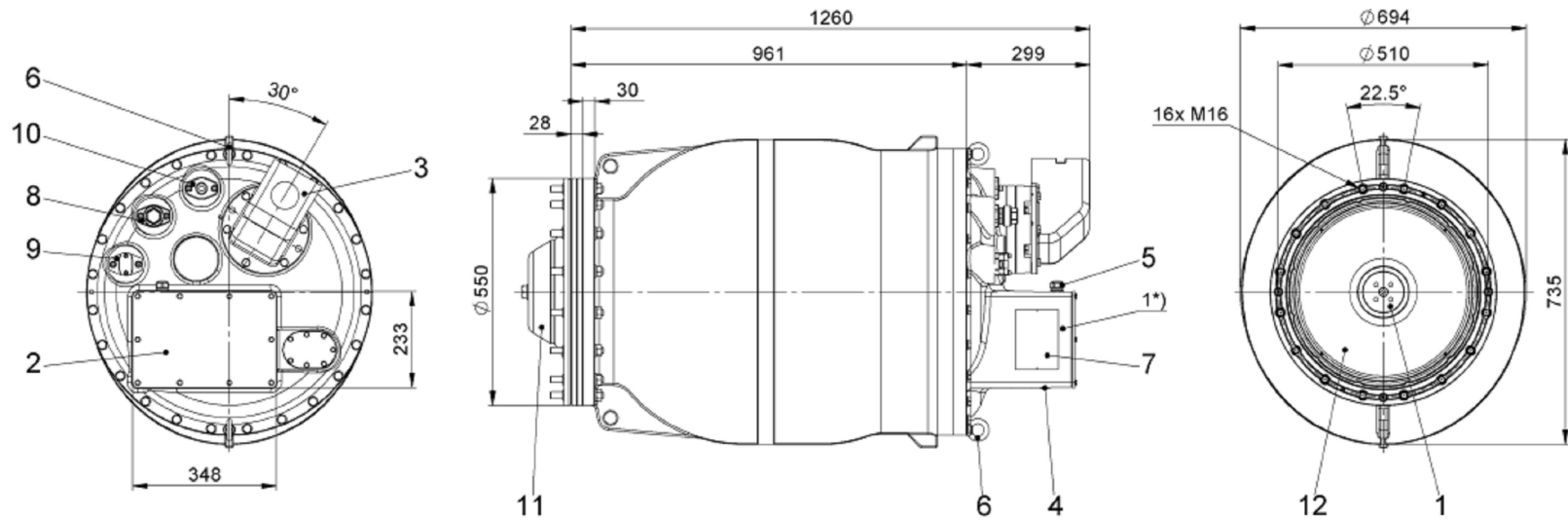
NO	DIMENSION	UNIT	VALUE
8.1	Applicable standards	IEC	62271-102, 62271-203
8.2	Type		fast closing (spring) slow opening (motor)
8.3	Designation		ELK-EB3
8.4	Rated normal current	A	100
8.5	Number of operating mechanisms per 3 phases		1
8.6	Rated lightning impulse withstand voltage - phase to earth - across open contacts	kV kV	1425 1425 +345
8.7	Rated switching impulse withstand voltage - phase to earth - across open contacts	kV kV	1050 1050 + 345
8.8	Rated power frequency withstand voltage - phase to earth - across open contacts	kV kV	650 815
8.9	Rated short circuit making current (peak)	kA	163
8.10	Rated induced inductive current at 25 kV	A	160
8.11	Rated induced capacitive current at 25 kV	A	18
8.12	Electrical endurance class according IEC		Class E1
8.13	Induced current switching duty class according IEC		Class B
8.14	Number of CO-operations before overhaul	CO	2000
8.15	Number of C operation at rated short-circuit making current	C	2
8.16	Withstand voltage of insulation to earth (if applicable)	kV	10
8.17	Operating time - Closing time - Opening time	ms s	≤ 50 2
8.18	Approx. volume of SF6 gas	dm ³	108
8.19	Approx. weight	kg	118

1) ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED

-  Life parts under high voltage
-  Enclosure
-  SF₆-gas
-  Insulation material
-  Mechanical parts, structures

PROJECT	2X660 MW UDANGUDI SUPERCRITICAL TPS, STAGE-I
CUSTOMER	 TAMILNADU GENERATION AND DISTRIBUTION CORPORATION LIMITED (TANGEDCO)
CONSULTANT	 TATA CONSULTING ENGINEERS LIMITED BENGALURU
 Bharat Heavy Electricals Ltd Transmission Business Group Noida	

Desk 20.04.2020	Debasish Mahapatra	Derived from: -	Separate BOM: -	Scale NTS	Doc type DW1	Format A4
Approved: 20.04.2020	Anurag Pandit	Replaces: -	SF6 SWITCHGEAR ELK-3/420 2x660 MW UDANGUDI TPS, STAGE-I		 Language EN Sheets 001	
Released: 20.04.2020	Debasish Mahapatra	Responsible department: PGHV-GIS ENG	400kV FAST ACTING EARTH SWITCH ELK EB 3		 Sheet no. 001	
Order number: 3100115843		Revision: AB	Document number: 1HYVG900056-114		Sheet no. 001	
 ABB India Ltd Under license of ABB Technology Ltd						





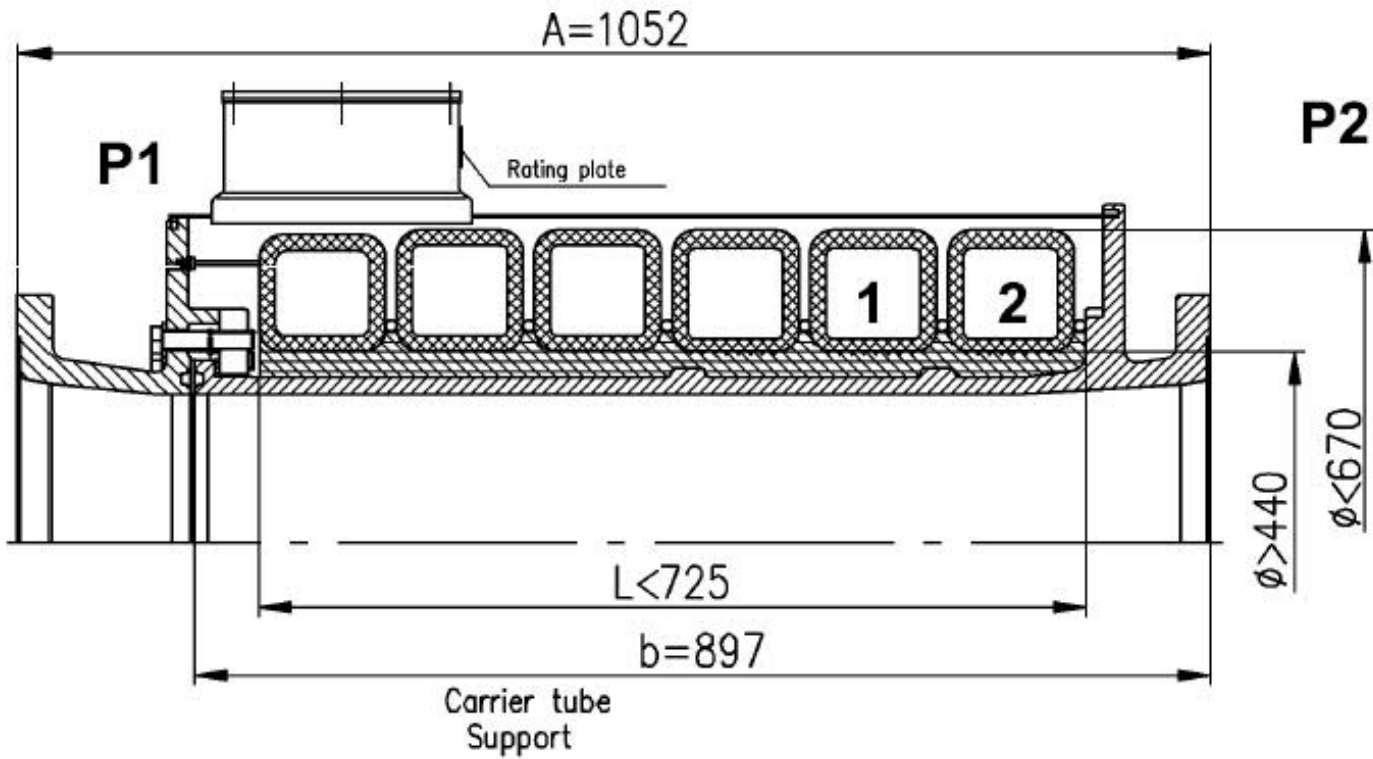
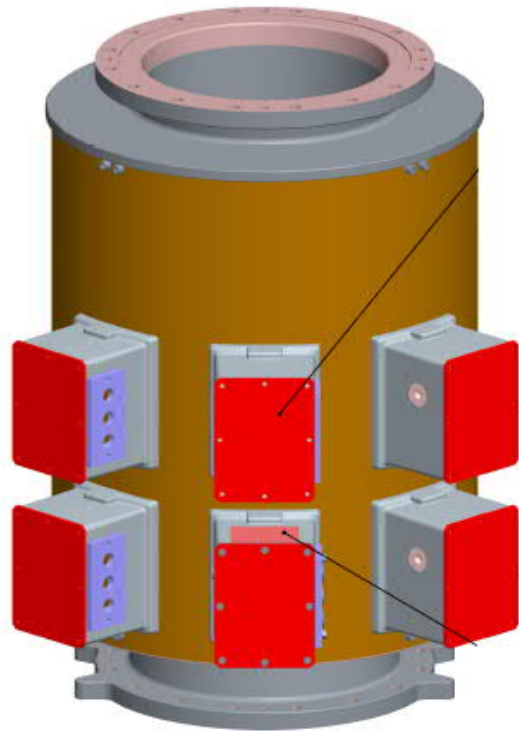
1. Primary terminal
2. Secondary terminal box with modular terminal block for conductors of 10mm² cross section
3. Pressure relief device ABB 1HC0074338 M10/M20
4. Cable gland entries
Standard: (3x) M25x1.5
5. Aeration device
6. Eye bolt M12
7. Rating plates incl. gas data
8. Filling valve ABB HATE100434 R4/R5
9. Valve for density monitoring ABB HATE100434 R6
10. Arc detector ABB HATE100434 R3
alternative: Blind cover ABB HATE100434 R1
11. Transport cover ABB 1HC0030987 R1
12. IG Insulator ABB 1HC0028418 M101

Eqpt. Name :? TECHNICAL PARTICULARS

NO	DIMENSION	UNIT	VALUE
10.1	Applicable standards	IEC	60044-2, 62271-203
10.2	Type		Inductive
10.3	Designation		ELK-PI3/420
	Number of cores		4/3
10.4	Rated lightning impulse withstand voltage	kV	1425
10.5	Rated switching impulse withstand voltage	kV	1050
	Rated power frequency voltage		
10.6	- Primary winding	kV	650
	- Secondary winding	kV	3
10.7	Insulation Level	Class	Class E
	Rated short circuit current		
10.8	Primary	A	0.266
	Secondary	A	1018
	Temperature Rise		
10.9	Primary Winding	K	<65
	Secondary Winding	K	<65
	PF withstand Test Voltage		
10.10	Primary	kV	650
	Secondary	kV	3
10.11	Partial discharge Level	pC	<2
10.12	Rated voltage factor		1.2/cont. 1.9/8h
10.13	Total thermal rating	VA	4x500 (For 4 core) 3x500 (For 3 core)
10.14	Approx. Volume of SF6 gas	dm ³	max. 370
10.15	Approx. Weight	kg	Max. 600

1) ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED

PROJECT	2X660 MW UDANGUDI SUPERCRITICAL TPS, STAGE-I				
CUSTOMER	 TAMILNADU GENERATION AND DISTRIBUTION CORPORATION LIMITED (TANGEDCO)				
CONSULTANT	 TATA CONSULTING ENGINEERS LIMITED BENGALURU				
	BHARAT HEAVY ELECTRICALS LTD TRANSMISSION BUSINESS GROUP NOIDA				
Draft:	20.04.2020	Debasish Mahapatra	Derived from:	-	Separate BOM:
Approved:	20.04.2020	Anurag Pandit	Replaces:	-	NTS
Released:	20.04.2020	Debasish Mahapatra	Responsible department:	PGHV-GIS ENGG	Doc type:
Order number:	3100115843		Revised:	AA	DW1
				400kV VT	Format:
				VOLTAGE TRANSFORMER	A0
				1HYG900056-115	EN
					Sheet no:
					001








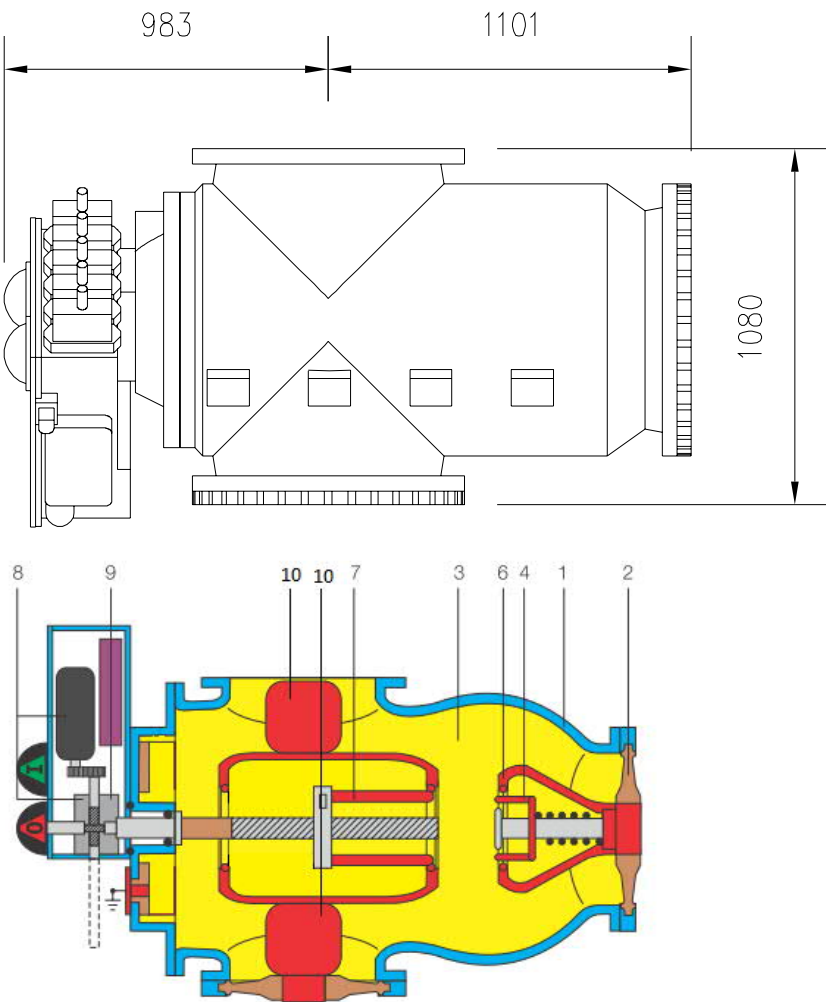
Eqpt Name:?

 TECHNICAL PARTICULARS

NO	DIMENSION	UNIT	VALUE
11.1	Applicable standards	IEC	60044-1, 62271-203
11.2	Type		Inductive
11.3	Designation		ELK-CN3
11.4	Number of cores		3/2
11.5	Rated lightning impulse withstand voltage	kV	1425
11.6	Rated switching impulse withstand voltage	kV	1050
11.7	Rated power frequency voltage	kV	650
11.8	Insulation Level	Class	Class E
11.9	Rated short circuit current	kA	63
	Duration	s	3
11.10	Temperature Rise (As per IEC 60044-1, Table-2)		
	Primary Winding	K	<75
11.11	PF withstand Test Voltage		
	Primary	kV	650
	Secondary	kV	3
11.12	Partial discharge Level	pC	<5
11.13	Approx. volume of SF6 gas	dm ³	160
11.14	Approx. weight	kg	850

1) ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED

PROJECT	2X660 MW UDANGUDI SUPERCRITICAL TPS, STAGE-I				
CUSTOMER	 TAMILNADU GENERATION AND DISTRIBUTION CORPORATION LIMITED (TANGEDCO)				
CONSULTANT	 TATA CONSULTING ENGINEERS LIMITED BENGALURU				
 Bharat Heavy Electricals Company	BHARAT HEAVY ELECTRICALS LTD TRANSMISSION BUSINESS GROUP NOIDA				
Draft 20.04.2020 Debasish Mahapatra	Derived from -	Separate BOM -	Scale NTS	Doc. type DW1	Format A0
Approved 20.04.2020 Anurag Pandit	Replaces -	SF6 SWITCHGEAR ELK-3/420 2x660 MW UDANGUDI TPS,STAGE-I			 Language EN No. Sheets 001
Released 20.04.2020 Debasish Mahapatra	Responsible department PGHV-GIS ENGG	400kV CT CURRENT TRANSFORMER			
Order number 3100115843	Revision AA	Bicament number 1HYG900056-116			
 ABB India Ltd under license of ABB Technology Ltd					Sheet no. 001



Legend

- 1 Enclosulre

2 Insulator

3 SF6-gas

4 Arching contact
- 6 Fixed contact for disconnector

7 Moving contact

10 Tulip contact
- 8 Motor/gear

9 Control unit/inter face module

Life parts under high voltage

Enclosure

SF₆-gas

Insulation material

Mechanical parts, structures






NOTES

1) ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED

TECHNICAL PARTICULARS

Eqpt Name:?

NO	DIMENSION	UNIT	VALUE
6.1	Applicable standards	IEC	62271-102, 62271-203
6.2	Type		Motor operated
6.3	Designation		ELK-TK3
6.4	Number of operating mechanisms per 3 phases		1
6.5	Rated lightning impulse withstand voltage - phase to earth - across open contacts	kV kV	1425 1425 +345
6.6	Rated switching impulse withstand voltage - phase to earth - across open contacts	kV kV	1050 1050 + 345
6.7	Rated power frequency withstand voltage - phase to earth - across open contacts	kV kV	650 815
6.8	Rated normal current (For Disconnector)	A	4000
6.19	Rated short time withstand current I _k	kA	63
6.10	Switching of bus charging current (capacitive current)	A	0.5
6.11	Bus transfer current switching	A	1600
6.12	Bus transfer voltage	V	20
6.13	Opening time (time until contact separation)	s	≤ 1
6.14	Closing time (time until contact touch)	s	≤ 2
6.15	Number of CO-operations before overhaul	CO	10000
6.16	Approx. volume of SF6 gas	dm ³	219
6.17	Approx. weight	kg	183

PROJECT	2X660 MW UDANGUDI SUPERCRITICAL TPS, STAGE-I					
CUSTOMER	 TAMILNADU GENERATION AND DISTRIBUTION CORPORATION LIMITED (TANGEDCO)					
CONSULTANT	 TATA CONSULTING ENGINEERS LIMITED BENGALURU					
	BHARAT HEAVY ELECTRICALS LTD TRANSMISSION BUSINESS GROUP NOIDA					
Draft 20.04.2020	Debasish Mahapatra	Derived from -	Separate BOM -	Scale NTS	Doc. type DW1	
Approved 20.04.2020	Anurag Pandit	Replaces -	SF6 SWITCHGEAR ELK-3/420 2x660 MW UDANGUDI TPS, STAGE-I			
Released 20.04.2020	Debasish Mahapatra	Responsible department PGHV-GIS ENGG				
Order number 3100115843	Revision AA	400kV ISOLATOR / SECTIONALIZER ELK TK3		Language EN No. Sheets 001		
 ABB India Ltd under license of ABB Technology Ltd		Document number 1HYG900056-117		Sheet no. 001		