FUEL FIRING
PE (BOILERS)

ANNEXURE – V (a)
PUMP DATA SHEET

A.PERFORMANCE DATA			**F. MECHANICAL SEAL**		
1. OIL GRADE			1.ACTION	SINGLE OR DOUBLE ?	
2. OIL POUR POINT			2.MAKE		
3. SP.GRAVITY AT 15^0C			3.MODEL No.& SIZE		
4.PUMPING TEMP.			4.O RING SPRING MATL.		
5. OIL VISCOSITY min/max		CST	5.ROTARY RING MATL.		
6.CAPACITY AT min.CST	LPM		6.STATIONARY RING MATL.		
7.CAPACITY AT max. CST	LPM		7.SUCTION PRESS. MAX.	Kg/Cm^2 (g)	
8.SUCTION PRESSURE	Kg/Cm^2 (g)				
9.DELIVERY PRESSURE	Kg/Cm^2 (g)		**G.SAFETY RELIEF VALVE - INTEGRAL**		
10.NPSH REQUIRED	<5 METERS WC AT MAX.CST		1.MAKE		
11.RPM			2.MODEL No.& SIZE		
12.SENSE OF ROTATION	CW AS SEEN FROM MOTOR END		3.CAPACITY		
13.BHP AT min.CST	KW		4.SET PRESSURE	5 Kg/Cm^2 (g) above delivery press	
14.BHP AT max. CST	KW		5.OVER PRESSURE		
15. PUMP EFFICIENCY	% @ MIN. cst.		6.SPRING ADJUST RANGE	Kg/Cm^2 (g) TO	Kg/Cm^2 (g)
			7.RELIEF OUTLET	INTERNAL OR EXTERNAL	
B.PERFORMANCE GRAPHS			8. RELIEF OUTLET CONN.	INCH, 350LBS FLANGED	
1.PRESS.VS FLOW & BHP			9.HANDWHEEL		
2.CST VS NPSH REQD.					
3.SPEED VS TORQUE			**H.STEAM JACKET**	**NOT REQUIRED**	
			1.STYLE	End cover or full jacket	
C.PUMP CONSTRUCTION DETAILS			2.PRESS. DESIGN/TEST	Kg/Cm^2 (g)	Kg/Cm^2 (g)
1.MOUNTING	Vertical / Horizontal / Flange / Foot		3.CONNECTION IN / OUT	Inch npt(f)	Inch npt(f)
2.PITCH & ROTOR DIA	mm	mm			
3.PUMP GD^2	Kg / Cm^2		I.DRIVE MOTOR SCOPE (PURCHASERS SCOPE)		
4.NOZZLES IN	INCH 150LBS FLANGED		1.MAKE OR FRAME SIZE		
5.NOZZLES OUT	INCH 300 LBS FLANGED		2.KW,V,PHASE& HZ		
6.INLET NOZZLE POSITION	Horizontal axial thru end cover		3.DIMENSIONAL DRG.		
7.OUTLET NOZZLE POSIT.	Vertical Top		4.DATA SHEET REF.		
8.BODY & COVER MATL.					
9.INSERT MATL.			J.PERFORMANCE GUARANTEE		
10.ROTOR SHAFT MATL			1.PER VDMA 24284 GROUP-II and Ref Special requirements.		
11.IDLERS MATL					
12.BEARING BUSH MATL.					
13.BASE FRAME MATL			**K.TEST CERTIFICATES & INSPECTION**		
14.BODY DESIGN /TEST PR.	Kg/Cm^2 (g)	Kg/Cm^2 (g)	1.BODY HYDRO TEST ;		
			2. PERFORMANCE TEST ON EACH CARTRIDGE		
D.BEARINGS			3.RELIEF VALVE OVER PRESSURE TEST		
1.TYPE AND NUMBER OFF					
2.POSITION	EXTERNAL		**L. O & M REFF. DOCUMENTS (fill compulsorily)**		
3.ISO No. & CLEARANCE			1.PUMP DESIGNATION SHEET :		
4.LUBRICANT GRADE			2.PERFORMANCE GRAPHS : AS UNDER SECTION - B		
5.QTY. & FILLING FREQ.			3.DIMENSIONAL DRAWINGS :		
			PUMP - MOTOR ASSY.		
E.COUPLING (3PIECE, PIN - PUSH)			PUMP :	CARTRIDGE:	
1.MAKE			RLF. VALVE :	COUPLING :	
2.MODEL No. & SIZE			4.SECTIONAL DRGS. WITH SPARES IDENTIFICATION :		
3.GD^2	Kg / Cm^2		PUMP BODY :	CARTRIDGE :	
4.DOUBLE PIECE SIDE	Fitted onto pump shaft in flush		RLF. VALVE :	SEAL :	
5.SINGLE PIECE	To fit motor shaft in rough bore condn.		5. O&M INSTRUCTIONS :		
			PUMP ;		
			COUPLING :	SEAL :	

PREPARED BY (VENDOR)	**DATE**	**APPROVED BY (BHEL)**	**DATE**

ANNEXURE – V(b)

FO PUMP - MOTOR ENQUIRY DATA SHEET

FUEL SYSTEMS / PE(BOILERS)

PROJECT					
CUSTOMER NO					
SERVICE					
BHEL MATL. CODE					
QUANTITY					
MOTOR DETAILS:					
POWER OUTPUT REQD.	KW				
POWER SOURCE		415V ± 10%; 50 HZ ± 5%; COMBINED ± 10 %; 3 PHASE			
TYPE		TEFC SQUIRREL CAGE INDUCTION MOTOR			
ENCLOSURE		IP 55; FLAME PROOF			
DUTY		CONTINUOUS			
DIRECTION OF ROTATION		ANTI CLOCK WISE SEEN FROM PUMP END			
METHOD OF STARTING		DIRECT ON LINE (DOL)			
MOUNTING		HORIZONTAL FOOT			
LOAD DATA					
DRIVEN PUMP TYPE		TRIPLE SCREW POSITIVE DISPLACEMENT			
COUPLING TYPE		PIN TYPE FLEXIBLE COUPLING			
PUMP SPEED	RPM				
PUMP GD^2	$KG.M^2$				
COUPLING GD^2	$KG.M^2$				
GD^2 TOTAL	$KG.M^2$				
TORQUE AT ZERO SPEED	KG. M				
TORQUE AT 5 % SPEED	KG. M				
TORQUE AT RATED SPEED	KG. M				
TORQUE VARIES LINEARLY WITH SPEED BETWEEN VALUES INDICATED ABOVE					
LT MOTOR SPEC. NO & DATA SHEET NO.		TCI 141 / Rev.08	TCI 141 / Rev.08		

PREPARED	DATE	APPROVED	DATE

बी एच ई एल BHEL	**Specification for** **FO Duplex Type 6-Port Integral Change Over Cock Strainer**	

Data sheet (To be filled and submitted for approval)

Sl.	Parameters	Requirement	Vendor's confirmation
01	Service		
02	Tag No.		
03	BHEL Matl. Code		
04	Quantity		
05	Make		
06	Production Sl. No.		
07	Model No.		
08	Line Fluid		
09	Flow Maximum		
10	Pour point		
11	Operating Pressure		
12	Flow Temperature		
13	Flow Sp. gravity		
14	Flow viscosity		
15	Line size		
16	Body size		
17	Body rating		
18	Body material		
19	Cover material		
20	Cock material		
21	Gasket material		
22	Body test pressure		
23	Cock seat test pressure		
24	Cock leak rate		
25	No. of per section		
26	Degree of filtration		
27	Filtering direction	IN TO OUT	
28	Total filter area/section		
29	Net filter area/section		
30	DP when clean		
31	DP at 50% clogged		
32	Max. allowable DP		
33	Mesh material		
34	Support gauze material		
35	Steam Jacketing		
36	Equalising valve		
37	IN / OUT nozzle		
38	Drain		
39	Vent		
40	Pressure gauge		
41	Testing code		
42	Dimensional Drg.		

ANNEXURE – V (d)

PART - I: DATASHEET FOR TRIP VALVE

BHEL MATERIAL CODE : ENQUIRY No. :
SERVICE :
TAG NO :
UNITS: Flow-Liquid Cu M / hr, Steam-Kg / hr, Gas-NCu/hr, Pr-kg /cmSq(g), Temp°c

O.FLOW DATA		**C.SOLENOID PILOT**			
1. Line Fluid		1. Make / Type No			
2. Flow Max		2. Style			
3. Normal in pr		3. To Open Main Valve			
4. Allowable DP		4. To Close Main Valve			
5. Actuator Sizing DP		5. Enclosure			
6. Temp Max		6. Coil Duty	Continuous, for 100° C ambient		
7.Flow Temp		7. Coil Rating			
8. Flow Sp Gravity		8. Insulation Class			
9. Flow Viscosity		9. Inrush / Hold Wattage			
10. Max Flow Cv		10. Valve Flow Cv			
11. Plug Life%		11. Body Matl			
12. Valve Cv		12. Wetted parts	Forged Brass		
13. Valve Closing Time	Sec.	13. Seating	Stainless Steel		
14. Valve Opening Time	Sec.Adjustable	14. Valve Ends	Resilient for tight shut		
		15. Cable entry			
A. VALVE BODY		16. Terminal Block	Provided		
1. Make/Type No		**D. QUICK EXHAUST VL**	To meet 0.13		
2. Line Size	ODXT mm	1. Make/type No			
3. Body/port Size	Nb mm	2. Port Conn			
4. Plug Travel	Mm				
5. Body Style / Rating	NP	**E. FLOW RESTRICTOR**	To meet 0.14		
6. Ends	Flanged to :	1. Make/Type No			
7. Port		2. Port Conn			
8. Guiding	Cage or Top & Bottom	3. Adjustable Time Range			
9. Body Material	Carbon Steel, ASTM A216 WCB				
10. Trim No		**F. AIRSET**	Type No		
11. Plug Matl		1. Airset set pr			
12. Steam Size/Material					
13.Seat, Material		**G.LIMIT SWITCHES**			**off**
14. Cage Material		1. Make/Type No			
15.Plug/Gage Style		2. Mounted For	Full open	Full close	% Open
16. Seat Leak Class	to ANSI FCI 70-2	3. Contacts			Off
17. Plug pushdown to		4. Contact Rating	240Ac 10Amp	220 Dc 0.25 Amp	
18. Flow Tends to		5. Enclosure			
19. Bonnet / packing		6.Cable Entry			
20. Lub/Isol Valve		**H. TERMINATION BOX**	Provided		
21. Drain Valve		1.Enclosure			
22. Noise Level		2. No. of Terminals			
		I.SUPPLY CONDITION			
		1. Assembly – 1			
		2. Assembly – 2			
		3. Pneumatic terminal		To suit 8 mm tube	
B. ACTUATOR ASSY		4. Spares	Individually tagged and packed		
1. Make/Type No					
2. Style		**REF. DOCUMENTS:(SPECIFY DWG/MANUAL REF.NOs. BELOW)**			
3. Size/Volume		1.Assy Dimensional Dwg			
4. Diaphragm Matl		2.Assy Hookup Dwg			
5.Spring No/Range		S.NO	ITEM	O & M Manual	Spares identifier Catalog&Spec
6. Spring No/Range					
7. Air to		3	A		
8. Signal pr		4	B		
9. Pr port Conn		5	B 11		
10. On Air Failure	Stay Put	6	C		
11. Lockup Valve type No		7	D		
12. Lockup Valve Set pr		8	E		
		9	F		
		10	G		

PART - I: DATASHEET FOR TRIP VALVE

BHEL MATERIAL CODE : ENQUIRY No. :
SERVICE : TAG NO
:

UNITS: Flow-Liquid Cu M / hr, Steam-Kg / hr, Gas-NCu/hr, Pr-kg /cmSq(g), Temp°c

O.FLOW DATA		**C.SOLENOID PILOT**	
1. Line Fluid		1. Make / Type No	
2. Flow Max		2. Style	
3. Normal in pr		3. To Open Main Valve	
4. Allowable DP		4. To Close Main Valve	
5. Actuator Sizing DP		5. Enclosure	
6. Temp Max		6. Coil Duty	Continuous, for 100° C ambient
7.Flow Temp		7. Coil Rating	240V DC
8. Flow Sp Gravity		8. Insulation Class	
9. Flow Viscosity		9. Inrush / Hold Wattage	
10. Max Flow Cv		10. Valve Flow Cv	
11. Plug Life%		11. Body Matl	
12. Valve Cv		12. Wetted parts	Forged Brass
13. Valve Closing Time	Sec.	13. Seating	Stainless Steel
14. Valve Opening Time	Sec.Adjustable	14. Valve Ends	Resilient for tight shut
		15. Cable entry	
A. VALVE BODY		16. Terminal Block	Provided
1. Make/Type No		**D. QUICK EXHAUST VL**	To meet 0.13
2. Line Size	ODXT mm	1. Make/type No	
3. Body/port Size	Nb mm	2. Port Conn	
4. Plug Travel	Mm		
5. Body Style / Rating	NP	**E. FLOW RESTRICTOR**	To meet 0.14
6. Ends	Flanged to :	1. Make/Type No	
7. Port		2. Port Conn	
8. Guiding	Cage or Top & Bottom	3. Adjustable Time Range	
9. Body Material	Carbon Steel, ASTM A216 WCB		
10. Trim No		**F. AIRSET**	Type No
11. Plug Matl		1. Airset set pr	
12. Steam Size/Material			
13.Seat, Material		**G.LIMIT SWITCHES**	**off**
14. Cage Material		1. Make/Type No	
15.Plug/Gage Style		2. Mounted For	Full open / Full close / % Open
16. Seat Leak Class	to ANSI FCI 70-2	3. Contacts	Off
17. Plug pushdown to		4. Contact Rating	240Ac 10Amp / 220 Dc 0.25 Amp
18. Flow Tends to		5. Enclosure	
19. Bonnet / packing		6.Cable Entry	
20. Lub/Isol Valve		**H. TERMINATION BOX**	Provided
21. Drain Valve		1.Enclosure	
22. Noise Level		2. No. of Terminals	
		I.SUPPLY CONDITION	
		1. Assembly – 1	
		2. Assembly – 2	
		3. Pneumatic rminal	To suit 8 mm tube
B. ACTUATOR ASSY		4. Spares	Individually tagged and packed
1. Make/Type No			
2. Style		**REF. DOCUMENTS:(SPECIFY DWG/MANUAL REF.NOs. BELOW)**	
3. Size/Volume		1.Assy Dimensional Dwg	
4. Diaphragm Matl		2.Assy Hookup Dwg	
5.Spring No/Range		S.NO / ITEM / O & M Manual / Spares identifier Catalog&Spec	
6. Spring No/Range			
7. Air to		3 A	
8. Signal pr		4 B	
9. Pr port Conn		5 B 11	
10. On Air Failure	Stay Put	6 C	
11. Lockup Valve type No		7 D	
12. Lockup Valve Set pr		8 E	
		9 F	
		10 G	

PART - I: DATASHEET FOR TRIP VALVE

BHEL MATERIAL CODE : ENQUIRY No. :

SERVICE :

TAG NO :

UNITS: Flow-Liquid Cu M / hr, Steam-Kg / hr, Gas-NCu/hr, Pr-kg /cmSq(g), Temp°c

O.FLOW DATA		**C.SOLENOID PILOT**				
1. Line Fluid		1. Make / Type No				
2. Flow Max		2. Style				
3. Normal in pr		3. To Open Main Valve				
4. Allowable DP		4. To Close Main Valve				
5. Actuator Sizing DP		5. Enclosure				
6. Temp Max		6. Coil Duty	Continuous, for 100° C ambient			
7.Flow Temp		7. Coil Rating	240V DC			
8. Flow Sp Gravity		8. Insulation Class				
9. Flow Viscosity		9. Inrush / Hold Wattage				
10. Max Flow Cv		10. Valve Flow Cv				
11. Plug Life%		11. Body Matl				
12. Valve Cv		12. Wetted parts	Forged Brass			
13. Valve Closing Time	Sec.	13. Seating	Stainless Steel			
14. Valve Opening Time	Sec.Adjustable	14. Valve Ends	Resilient for tight shut			
		15. Cable entry				
A. VALVE BODY		16. Terminal Block	Provided			
1. Make/Type No		**D. QUICK EXHAUST VL**	To meet 0.13			
2. Line Size	ODXT mm	1. Make/type No				
3. Body/port Size	Nb mm	2. Port Conn				
4. Plug Travel	Mm					
5. Body Style / Rating	NP	**E. FLOW RESTRICTOR**	To meet 0.14			
6. Ends	Flanged to :	1. Make/Type No				
7. Port		2. Port Conn				
8. Guiding	Cage or Top & Bottom	3. Adjustable Time Range				
9. Body Material	Carbon Steel, ASTM A216 WCB					
10. Trim No		**F. AIRSET**	Type No			
11. Plug Matl		1. Airset set pr				
12. Steam Size/Material						
13.Seat, Material		**G.LIMIT SWITCHES**				**off**
14. Cage Material		1. Make/Type No				
15.Plug/Gage Style		2. Mounted For	Full open	Full close	% Open	
16. Seat Leak Class	to ANSI FCI 70-2	3. Contacts			Off	
17. Plug pushdown to		4. Contact Rating	240Ac 10Amp	220 Dc 0.25 Amp		
18. Flow Tends to		5. Enclosure				
19. Bonnet / packing		6.Cable Entry				
20. Lub/Isol Valve		**H. TERMINATION BOX**	Provided			
21. Drain Valve		1.Enclosure				
22. Noise Level		2. No. of Terminals				
		I.SUPPLY CONDITION				
		1. Assembly - 1				
		2. Assembly - 2				
		3. Pneumatic rminal				
B. ACTUATOR ASSY		4. Spares	Individually tagged and packed			
1. Make/Type No						
2. Style		**REF. DOCUMENTS:(SPECIFY DWG/MANUAL REF.NOs. BELOW)**				
3. Size/Volume		1.Assy Dimensional Dwg				
4. Diaphragm Matl		2.Assy Hookup Dwg				

5.Spring No/Range			S.NO	ITEM	O & M Manual	Spares identifier Catalog &Spec
6. Spring No/Range						
7. Air to			3	A		
8. Signal pr			4	B		
9. Pr port Conn			5	B 11		
10. On Air Failure	Stay Put		6	C		
11. Lockup Valve type No			7	D		
12. Lockup Valve Set pr			8	E		
			9	F		
			10	G		

ANNEXURE – V(e)

PART - I: DATASHEET FOR CONTROL VALVE

BHEL MATEREIAL CODE: ENQUIRY NO :

SERVICE :

TAG NO :

UNITS: Flow--Liquid CuM/hr, Steam--Kg/hr, Gas--NCuM/hr,Pr.--Kg/cmsq (g), Temp--°C

O.FLOW DATA			C.POSITIONER	PNEUMATIC / ELECTRO PNEUMATIC	
1.Line Fluid			1.Make/Type No		
2.Flow Max			2. Action	Direct / Reverse Field Adjustable	
3.Flow Min			3. Supply Pr		
4.Max Flow in Pr			4.Bypass/Gauge	Provided	Three
5.Min Flow in Pr			5. Signal In/Out	0.2 to 1 kg/cm^2 (g)	
6.Max Flow out Pr			6. Air set make & type no		
7. Min Flow out Pr			7.Air set pr. range		
8.Actuator Sizing DP					
9.Temp Max			**D.SOLINOID VALVE**		
10.Flow Temp			1.Make / Type no		
11.Flow Sp Gravity			2.Style		
12.Flow Viscosity			3.Enclosure		
13.Max / Min Flow Cv			4.Valve flow CV		
14.plug Lifts @ max/minflow	%	%	5.Cable entry		
15.Valve Cv / Cf			E.TERMINAL BOX		
			1.Enclosure		
A.VALVE BODY			2.Terminals		
1.Make/Type No					
2.Line Size	OD X t mm				
3.Body/ Port Size	Nb mm	mm			
4.Plug Travel	Mm				
5.Body Style/Rating		NP	**F.POSITION TRANSMETER**		**off**
6.Ends			1.Make / Type no		
7.Ports			2.Style	3 Wire / 2 Wire	
8.Guiding	Cage or Top & Bottom		3.Input		
9.Body Matl			4.Load		
10.Trim No			5.Out Put		
11.Plug Matl			6.Cable Entry		
12.Stem Size/Matl			**G.LIMIT SWITCHES**	2 **off**	
13.Seat Matl			1.Make/Type no		
14.Cage Matl			2.Mounted for	Max. Plug lift / Min. Plug lift	
15.Plug/ Gauge Style			3.Contacts	Off	
16.Seat Leak Class			4.Contact Rating		
17.Plug Pushdown to			5.Enclosure		
18.Flow Tends to			6.Cable Entry Size		
19.Bonnet/Packing			**H.SUPPLY CONDITION**		
21.Drain Plug			1.Assembly-1		
22.Noise Level			2Assembly-2		
			3.Pneumatic Terminal	To suit 8mm OD x 1.65 mm t Tube	
B.ACTUATOR ASSY			4.Spares	Individually tagged & packed	
1.Make / type no					
2.Style					
3.Size/Volume			**I.REF. DOCUMENTS : SPECIFY DWG/ MANUAL REF. NOS.**		
4.Diaphragm Matl			1.Assy Dimentional Dwg	2.Assy Hookup Dwg	
5. Port Size	1/4 ” NPT		S.No Item O & M Manual	Spares identifier catalog & specfn.	
6.Spring no / Range			3. A		
7.Spring To			4. B		
8. Air To			5 . B12		
9. Signal Pr.			6. C		
10. Handwheel			7. C6		
11. On Air Failure	Stay Put		8. D		
12.Lockup Valve Type no			9. F		
13. Lockup Valve Set Pr.S			10. G		
			11.		

PART - I: DATASHEET FOR CONTROL VALVE

BHEL MATEREIAL CODE : ENQUIRY NO

SERVICE :

TAG NO :

UNITS: Flow--Liquid CuM/hr, Steam--Kg/hr, Gas--NCuM/hr,Pr.--Kg/cmsq (g), Temp--°C

O.FLOW DATA			C.POSITIONER	PNEUMATIC / ELECTRO PNEUMATIC	
1.Line Fluid			1.Make/Type No		
2.Flow Max			2. Action	Direct / Reverse Field Adjustable	
3.Flow Min			3. Supply Pr		
4.Max Flow in Pr			4.Bypass/Gauge	Provided	Three
5.Min Flow in Pr			5. Signal In/Out	0.2 to 1 kg/cm^2 (g)	
6.Max Flow out Pr			6. Air set make & type no		
7. Min Flow out Pr			7.Air set pr. range		
8.Actuator Sizing DP					
9.Temp Max			**D.SOLINOID VALVE**		
10.Flow Temp			1.Make / Type no		
11.Flow Sp Gravity			2.Style		
12.Flow Viscosity			3.Enclosure		
13.Max / Min Flow Cv			4.Valve flow CV		
14.plug Lifts @ max/minflow	%	%	5.Cable entry		
15.Valve Cv / Cf			E.TERMINAL BOX		
			1.Enclosure		
A.VALVE BODY			2.Terminals		
1.Make/Type No					
2.Line Size	OD X t mm				
3.Body/ Port Size	Nb mm	mm			
4.Plug Travel	Mm				
5.Body Style/Rating		NP	**F.POSITION TRANSMETER**		**off**
6.Ends			1.Make / Type no		
7.Ports			2.Style	3 Wire / 2 Wire	
8.Guiding	Cage or Top & Bottom		3.Input		
9.Body Matl			4.Load		
10.Trim No			5.Out Put		
11.Plug Matl			6.Cable Entry		
12.Stem Size/Matl			**G.LIMIT SWITCHES**	2 **off**	
13.Seat Matl			1.Make/Type no		
14.Cage Matl			2.Mounted for	Max. Plug lift / Min. Plug lift	
15.Plug/ Gauge Style			3.Contacts	Off	
16.Seat Leak Class			4.Contact Rating		
17.Plug Pushdown to			5.Enclosure		
18.Flow Tends to			6.Cable Entry Size		
19.Bonnet/Packing			**H.SUPPLY CONDITION**		
21.Drain Plug			1.Assembly-1		
22.Noise Level			2Assembly-2		
			3.Pneumatic Terminal	To suit 8mm OD x 1.65 mm t Tube	
B.ACTUATOR ASSY			4.Spares	Individually tagged & packed	
1.Make / type no					
2.Style					
3.Size/Volume			**I.REF. DOCUMENTS : SPECIFY DWG/ MANUAL REF. NOS.**		
4.Diaphragm Matl			1.Assy Dimentional Dwg	2.Assy Hookup Dwg	
5. Port Size	1/4 ” NPT		S.No Item O & M Manual	Spares identifier catalog & specfn.	
6.Spring no / Range			3. A		
7.Spring To			4. B		
8. Air To			5 . B12		
9. Signal Pr.			6. C		
10. Handwheel			7. C6		
11. On Air Failure	Stay Put		8. D		
12.Lockup Valve Type no			9. F		
13. Lockup Valve Set Pr.S			10. G		
			11.		

PART - I: DATASHEET FOR CONTROL VALVE

BHEL MATEREIAL CODE:
ENQUIRY NO :
SERVICE :

TAG NO :

UNITS: Flow--Liquid CuM/hr, Steam--Kg/hr, Gas--NCuM/hr,Pr.--Kg/cmsq (g), Temp--°C

O.FLOW DATA			C.POSITIONER	PNEUMATIC / ELECTRO PNEUMATIC	
1.Line Fluid			1.Make/Type No		
2.Flow Max			2. Action	Direct / Reverse Field Adjustable	
3.Flow Min			3. Supply Pr		
4.Max Flow in Pr			4.Bypass/Gauge	Provided	Three
5.Min Flow in Pr			5. Signal In/Out	0.2 to 1 kg/cm^2 (g)	
6.Max Flow out Pr			6. Air set make & type no		
7. Min Flow out Pr			7.Air set pr. range		
8.Actuator Sizing DP					
9.Temp Max			**D.SOLINOID VALVE**		
10.Flow Temp			1.Make / Type no		
11.Flow Sp Gravity			2.Style		
12.Flow Viscosity			3.Enclosure		
13.Max / Min Flow Cv			4.Valve flow CV		
14.plug Lifts @ max/minflow	%	%	5.Cable entry		
15.Valve Cv / Cf			E.TERMINAL BOX		
			1.Enclosure		
A.VALVE BODY			2.Terminals		
1.Make/Type No					
2.Line Size	OD X t	mm			
3.Body/ Port Size	Nb mm	mm			
4.Plug Travel	Mm				
5.Body Style/Rating		NP	**F.POSITION TRANSMETER**		**off**
6.Ends			1.Make / Type no		
7.Ports			2.Style	3 Wire / 2 Wire	
8.Guiding	Cage or Top & Bottom		3.Input		
9.Body Matl			4.Load		
10.Trim No			5.Out Put		
11.Plug Matl			6.Cable Entry		
12.Stem Size/Matl			**G.LIMIT SWITCHES**	2 **off**	
13.Seat Matl			1.Make/Type no		
14.Cage Matl			2.Mounted for	Max. Plug lift / Min. Plug lift	
15.Plug/ Gauge Style			3.Contacts		Off
16.Seat Leak Class			4.Contact Rating		
17.Plug Pushdown to			5.Enclosure		
18.Flow Tends to			6.Cable Entry Size		
19.Bonnet/Packing			**H.SUPPLY CONDITION**		
21.Drain Plug			1.Assembly-1		
22.Noise Level			2Assembly-2		
			3.Pneumatic Terminal	To suit 8mm OD x 1.65 mm t Tube	
B.ACTUATOR ASSY			4.Spares	Individually tagged & packed	
1.Make / type no					
2.Style					
3.Size/Volume			**I.REF. DOCUMENTS : SPECIFY DWG/ MANUAL REF. NOS.**		
4.Diaphragm Matl			1.Assy Dimentional Dwg	2.Assy Hookup Dwg	
5. Port Size	1/4 " NPT		S.No Item O & M Manual	Spares identifier catalog & specfn.	
6.Spring no / Range			3. A		
7.Spring To			4. B		
8. Air To			5 . B12		
9. Signal Pr.			6. C		
10. Handwheel			7. C6		
11. On Air Failure	Stay Put		8. D		
12.Lockup Valve Type no			9. F		
13. Lockup Valve Set Pr.S			10. G		
			11.		

PART - I: DATASHEET FOR CONTROL VALVE

BHEL MATEREIAL CODE: ENQUIRY NO :

SERVICE :

TAG NO :

UNITS: Flow--Liquid CuM/hr, Steam--Kg/hr, Gas--NCuM/hr,Pr.--Kg/cmsq (g), Temp--°C

O.FLOW DATA				C.POSITIONER	PNEUMATIC / ELECTRO PNEUMATIC	
1.Line Fluid				1.Make/Type No		
2.Flow Max				2. Action	Direct / Reverse Field Adjustable	
3.Flow Min				3. Supply Pr		
4.Max Flow in Pr				4.Bypass/Gauge	Provided	Three
5.Min Flow in Pr				5. Signal In/Out	0.2 to 1 kg/cm^2 (g)	
6.Max Flow out Pr				6. Air set make & type no		
7. Min Flow out Pr				7.Air set pr. range		
8.Actuator Sizing DP						
9.Temp Max				**D.SOLINOID VALVE**		
10.Flow Temp				1.Make / Type no		
11.Flow Sp Gravity				2.Style		
12.Flow Viscosity				3.Enclosure		
13.Max / Min Flow Cv				4.Valve flow CV		
14.plug Lifts @ max/minflow	%		%	5.Cable entry		
15.Valve Cv / Cf				E.TERMINAL BOX		
				1.Enclosure		
A.VALVE BODY				2.Terminals		
1.Make/Type No						
2.Line Size	OD X t	mm				
3.Body/ Port Size	Nb mm	mm				
4.Plug Travel	Mm					
5.Body Style/Rating		NP		**F.POSITION TRANSMITTER**		
6.Ends				1.Make / Type no		
7.Ports				2.Style	3 Wire / 2 Wire	
8.Guiding	Cage or Top & Bottom			3.Input		
9.Body Matl				4.Load		
10.Trim No				5.Out Put		
11.Plug Matl				6.Cable Entry		
12.Stem Size/Matl				**G.LIMIT SWITCHES**	2 **off**	
13.Seat Matl				1.Make/Type no		
14.Cage Matl				2.Mounted for	Max. Plug lift / Min. Plug lift	
15.Plug/ Gauge Style				3.Contacts		Off
16.Seat Leak Class				4.Contact Rating		
17.Plug Pushdown to				5.Enclosure		
18.Flow Tends to				6.Cable Entry Size		
19.Bonnet/Packing				**H.SUPPLY CONDITION**		
21.Drain Plug				1.Assembly-1		
22.Noise Level				2Assembly-2		
				3.Pneumatic Terminal	To suit 8mm OD x 1.65 mm t Tube	
B.ACTUATOR ASSY				4.Spares	Individually tagged & packed	
1.Make / type no						
2.Style						
3.Size/Volume				**I.REF. DOCUMENTS : SPECIFY DWG/ MANUAL REF. NOS.**		
4.Diaphragm Matl				1.Assy Dimentional Dwg	2.Assy Hookup Dwg	
5. Port Size	1/4 " NPT			S.No Item O & M Manual	Spares identifier catalog & specfn.	
6.Spring no / Range				3. A		
7.Spring To				4. B		
8. Air To				5 . B12		
9. Signal Pr.				6. C		
10. Handwheel				7. C6		
11. On Air Failure	Stay Put			8. D		
12.Lockup Valve Type no				9. F		
13. Lockup Valve Set Pr.S				10. G		
				11.		

ANNEXURE - VI(a)

MANUFACTURER'S NAME & ADDRESS **BHEL : TIRUCHIRAPPALLI / APPD. SUB-CONTRACTOR**	**MANUFACTURING QUALITY PLAN** ITEM : **AIR COOLED OIL GUN ASSEMBLY** QP : **CQP: 2296/ 01** SUB-SYSTEM : DATE : 29/ 11 /2006 PAGE 1 OF 5	PROJECT : KOSTI SUDAN , 4 x 125 MW PACKAGE : CONTRACT NO. : BHEL CUST.NO. : 0157, 0158, 0159 & 0160

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REF .DOCUMENT/ ACCEPTANCE NORMS		FORMAT OF RECORD	AGENCY			REMARKS
									M	B	C	
1	2	3	4	5	6	7	8	9	10			11
1.0	MATERIAL #	# Material shall be as per Drg.										
1.1	Plates,Bars,Tubes Rounds, Pipes , SA515 Gr70 SA240(304),SA479 Typ304,ASTM A600 T4 ,SA 213(304) SA106 GrB,	Chemical and Mechanical Properties	Critical	Review of Documents	100%	As per Material Spec.		TC	P	V	-	
1.2	Sub Deliveries											
1.2.1	Flexible Hoses Limit switches Air cylinder	Compliance to purchase order	Major	Review of Document	100%	Purchase Spec.		R	P	V	-	Procured from BHEL approved Sources

A Francis	GSN Murhty	**LEGEND :** M : manufacturer / sub contractor "B" BHEL QC / NDTL; "C" Customer/ NEC " R" records / dimensiona reports "p" perform, "W" witness, "V" verification as appropriate TC : test certificate / report WPS: weld procedure specification	**FOR CUSTOMER USE**	
PREPARED BY	REVIEWED & APPROVED BY		REVIEWED BY	NAME & SIGN. OF APPROVING AUTHORITY & SEAL
NAME & SIGNATURE				

ANNEXURE - VI(a)

MANUFACTURER'S NAME & ADDRESS **BHEL : TIRUCHIRAPPALLI / APPD. SUB-CONTRACTOR**	**MANUFACTURING QUALITY PLAN** ITEM : **AIR COOLED OIL GUN ASSEMBLY** QP : **CQP: 2296/ 01** SUB-SYSTEM : DATE : 29/ 11 /2006 PAGE 2 OF 5	PROJECT : KOSTI SUDAN , 4 x 125 MW PACKAGE : CONTRACT NO. : BHEL CUST.NO. : 0157, 0158, 0159 & 0160

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REF .DOCUMENT/ ACCEPTANCE NORMS		FORMAT OF RECORD	AGENCY			REMARKS
									M	B	C	
1	2	3	4	5	6	7	8	9	10			11
2.0	INPROCESS											
2.1	Marking,cutting and Preparation	Shape, Size Location of Holes	Major	Measurement	100%	Drawing		R	P	V	-	
2.2	Machining											
2.2.1	Spray Plates Machining	Size,Finish Orientation Of Holes & Lap finish	Major	Measurement & Visual	100%	Drawing		R	P	V	-	
	Nitriding	Sur.hardness #	Major	Measurement	sample	500 Vickers min at room temp		R	P	V	-	# Hardness & Case depth will be checked
		Case depth #	Major	Measurement	sample	Drawing						on one test specimen
2.2.2	Nozzle Body Machining	Dimension,Ori-entation and concentricity	Major	Measurement & Visual	100%	Drawing		R	P	V	-	
	Nitriding	Surface hardness #	Major	Measurement	sample	500 Vickers min at room temp		R	P	V	-	# Hardness & Case depth will be checked on one
		Case depth #	Major	Measurement	sample	Drawing						test specimen
2.2.3	Cap nut, Seal ring hub	Dimensions Finish	Major	Measurement & Visual	100%	Drawing		R	P	V	-	

ANNEXURE - VI(a)

MANUFACTURER'S NAME & ADDRESS **BHEL : TIRUCHIRAPPALLI / APPD. SUB-CONTRACTOR**	**MANUFACTURING QUALITY PLAN** ITEM : **AIR COOLED OIL GUN ASSEMBLY** QP : **CQP: 2296/ 01** SUB-SYSTEM : DATE : 29/ 11 /2006 PAGE 3 OF 5	PROJECT : KOSTI SUDAN , 4 x 125 MW PACKAGE : CONTRACT NO. : BHEL CUST.NO. : 0157, 0158, 0159 & 0160

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REF .DOCUMENT/ ACCEPTANCE NORMS		FORMAT OF RECORD	AGENCY			REMARKS
									M	B	C	
1	2	3	4	5	6	7	8	9	10			11
2.2.4	Removable union	Dimensions Orientation of steam and oil ports, finish	Major	Measurement Visual	100	Drawing		R	P	V	-	
		Leak-tightness		Hydro test	100%	Drawing		R	P	V	-	No leak is permitted.
2.2.5	Stationary union	Dimensions Orientation of Through holes,	Major	Measurement	100%	Drawing		R	P	V	-	
2.3	Oil gun pipes	Dimensions	Major	Measurement	100%	Drawing		R	P	V	-	
2.4	Nozzle body and Sleeve Sub assy	Dimension Orientation of sleeves gasket& washer	Major	Measurement.. and visual	100%	Drawing		R	P	V	-	
2.5	Welding	Procedure , Qualification	Major	Review of Document.	100%	AWS D 1.1.		WPS	P	V	-	
		Personnel Qualification	Major	-do-	100%	AWS D 1.1		R	P	V	-	

ANNEXURE - VI(a)

MANUFACTURER'S NAME & ADDRESS **BHEL : TIRUCHIRAPPALLI / APPD. SUB-CONTRACTOR**	**MANUFACTURING QUALITY PLAN** ITEM : **AIR COOLED OIL GUN ASSEMBLY** QP : **CQP: 2296/ 01** SUB-SYSTEM : DATE : 29/ 11 /2006 PAGE 4 OF 5	PROJECT : KOSTI SUDAN , 4 x 125 MW PACKAGE : CONTRACT NO. : BHEL CUST.NO. : 0157, 0158, 0159 & 0160

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REF .DOCUMENT/ ACCEPTANCE NORMS		FORMAT OF RECORD	AGENCY			REMARKS
									M	B	C	
1	2	3	4	5	6	7	8	9	10			11
2.5.1	Weld inspection	Weld size	Minor	Visual	100%	As per Drawing	-	P	V	-		
		Weld quality	Major	LPI/MPI	100%	AWS D 1.1	R	P	V	-		
2.6	Oil gun assembly	KF Dimension, Leak tightness thro' in side & outside port	Critical	Measurement Hydro test	100%	Drawing	R	P	W	-	No leak is permitted.	
2.7	Stationary Union assembly	Orientation of limit switch, clamp and attachments	Major	Visual	100%	Drawing	-	P	V	-		
2.8	Guide pipe, Diffuser assy. & Connecting pipe for AC gun	Dimensions, Location of vanes in diff-user Orienta-tion of flexible hoses and attachments	Major	Measurement visual	100%	Drawing	-	P	V	-		

ANNEXURE - VI(a)

MANUFACTURER'S NAME & ADDRESS **BHEL : TIRUCHIRAPPALLI / APPD. SUB-CONTRACTOR**	**MANUFACTURING QUALITY PLAN** ITEM : **AIR COOLED OIL GUN ASSEMBLY** QP : **CQP: 2296/ 01** SUB-SYSTEM : DATE : 29/ 11 /2006 PAGE 5 OF 5	PROJECT : KOSTI SUDAN , 4 x 125 MW PACKAGE : CONTRACT NO. : BHEL CUST.NO. : 0157, 0158, 0159 & 0160

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REF .DOCUMENT/ ACCEPTANCE NORMS		FORMAT OF RECORD	AGENCY			REMARKS
									M	B	C	
1	2	3	4	5	6	7	8	9	10			11
3.0	FINAL											
3.1	Air cooled oil gun assembly complete	Dimension, Orientation of components	Major	Measurement and visual	100%	Drawing		R	P	V	-	
3.2	Verification of completion	Overall dimns. Orientations	Major	Verificn. Visual	100%	As per drawing		-	P	V	-	
3.3	Painting, Preservation & protection	Finish Coat thickness	Minor	Visual Measurement	100% Random	Q:PL:C3-PS / 0157 & Drawing			P	V	-	
3.4	Identification	WO.No.,DU Project	Minor	Visual	100%	Drawing		-	P	V	-	

ANNEXURE VI(b)

MANUFACTURER'S NAME & ADDRESS BHEL : TIRUCHIRAPPALLI	MANUFACTURING QUALITY PLAN ITEM: OIL PREHEATING AND PRESSURIZING UNIT SUB-SYSTEM:	CQP NO. 2292 / 01 DATE.: 29 / 11/ 2006 PAGE 1 OF 4	PROJECT : KOSTI SUDAN , 4 x 125 MW PACKAGE : CONTRACT NO. : BHEL CUST.NO. : 0157, 0158, 0159 & 0160

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REF .DOCUMENT/ ACCEPTANCE NORMS		FORMAT OF RECORD	AGENCY			REMARKS
									M	B	C	
1	2	3	4	5	6	7	8	9	10			11
1.0	MATERIAL:											
1.1	Plates to SA 515 Gr 70 SA 299 IS 2062	Chemical & Mechanical Properties	Critical	Review of Document.	100%	Materials Specn.		TC	P	V	-	
		Soundness UT	Major	Review of Documents	100%#	Material Specn.		TC	P	V	-	# for plates above 40 mm
1.2	Tubes to SA 210 Gr.A1 SA 179	-do-	Critical	-do-	100%	-do-		TC	P	V	-	
1.3	Pipes to SA 106 Gr B	Chemical & Mechanical Properties	Critical	-do-	100%	-do-		TC	P	V	-	

A Francis	GSN Murhty	**LEGEND :** M : MANUFACTURER / SUB CONTRACTOR B : BHEL QC /NDTL C: CUSTOMER/ NEC P : PERFORM, V VERIFICATION , W: WITNESS R : TEST / DIMENSIONAL REPORTS TC: TEST CERTIFICATES / REPORTS WPS: WELDING PROCEDURE SPECIFICATION.	**FOR CUSTOMER USE**	
PREPARED BY	REVIEWED & APPROVED BY		REVIEWED BY	NAME & SIGN. OF APPROVING AUTHORITY & SEAL
NAME & SIGNATURE				

ANNEXURE VI(b)

MANUFACTURER'S NAME & ADDRESS BHEL : TIRUCHIRAPPALLI	MANUFACTURING QUALITY PLAN ITEM: OIL PREHEATING AND PRESSURIZING UNIT SUB-SYSTEM:	CQP NO. 2292 / 01 DATE.: 29 / 11/ 2006 PAGE 2 OF 4	PROJECT : KOSTI SUDAN , 4 x 125 MW PACKAGE : CONTRACT NO. : BHEL CUST.NO. : 0157, 0158, 0159 & 0160

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REF .DOCUMENT/ ACCEPTANCE NORMS		FORMAT OF RECORD	AGENCY			REMARKS
									M	B	C	
1	2	3	4	5	6	7	8	9	10			11
1.4	Sub-Deliveries											
1.4.1	Pumps,Strainers, Control valves, Steam traps & Motors	Compliance	Critical	Review of Document.	100%	Purchase Spec.		R	P	V	-	
2.0	INPROCESS:											
2.1	Welding	Procedure Qualification	Major	Document review	100%	AWS D1.1		WPS	P	V	-	
2.2	Fabrication											
2.2.1	Base frame	Weld quality	Major	LPI	100%	AWS D 1.1.		R	P	V	-	
2.2.2	Heater shell & Steam channel	soundness	Major	MPI	100%	AWS D 1.1		R	P	W	V	
2.3	Machining of Tube sheet & Baffle plates	Diameter & Thickness	Major	Measurement	100%	Drawing		R	P	V	-	
2.4	Baffle drilling.	Hole size& Finish	Major	Gauging & Visual	*	Drawing		R	P	V	-	*One plate per stack to be checked fully

ANNEXURE VI(b)

MANUFACTURER'S NAME & ADDRESS BHEL : TIRUCHIRAPPALLI	MANUFACTURING QUALITY PLAN ITEM: OIL PREHEATING AND PRESSURIZING UNIT SUB-SYSTEM:	CQP NO. 2292 / 01 DATE.: 29 / 11/ 2006 PAGE 3 OF 4	PROJECT : KOSTI SUDAN , 4 x 125 MW PACKAGE : CONTRACT NO. : BHEL CUST.NO. : 0157, 0158, 0159 & 0160

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REF .DOCUMENT/ ACCEPTANCE NORMS		FORMAT OF RECORD	AGENCY			REMARKS
									M	B	C	
1	2	3	4	5	6	7	8	9	10			11
2.5	Expansion holes for tube sheets	Size & Finish	Major	Gauging & Visual	100%	Drawing		R	P	W	V	
		Hole size	Major	Measurement	10%	-do-		R	P	V	-	10% of holes shall be used for thinning calculation after expansion
2.6	Tube expansion	ID Increase	Major	Gauging	100%	-do-		R	P	V	-	
		Thinning	Major	Measurement	10%	-do-		R	P	V	-	For holes whose diameter is measured vide 2.5
2.7	Tube to Tube sheet welding	Weld Quality	Major	LPI	100%	AWS D 1.1.		R	P	W	V	

ANNEXURE VI(b)

MANUFACTURER'S NAME & ADDRESS BHEL : TIRUCHIRAPPALLI	MANUFACTURING QUALITY PLAN ITEM: OIL PREHEATING AND PRESSURIZING UNIT SUB-SYSTEM:	CQP NO. 2292 / 01 DATE.: 29 / 11/ 2006 PAGE 4 OF 4	PROJECT : KOSTI SUDAN , 4 x 125 MW PACKAGE : CONTRACT NO. : BHEL CUST.NO. : 0157, 0158, 0159 & 0160

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REF .DOCUMENT/ ACCEPTANCE NORMS		FORMAT OF RECORD	AGENCY			REMARKS
									M	B	C	
1	2	3	4	5	6	7	8	9	10			11
3.0	FINAL:											
3.1	Assembly of Heater,Pump & Motor.	Completeness	Major	Visual	100%	Drawing		-				
		Termial dimensions		Measurement	100%	Drawing		R	P	W	V	
3.2	Hydraulic test: Tube side & shell side	Leak tightness	Critical	Visual	100%	Drawing		R	P	W	V	
3.3	Painting & Preservation	Paint finish	Minor	Visual	100%	Q:PL:C3-PS / 0157		-	P	V	-	
		Coat thickness		Measurement	Random							
		Identification	Minor	Visual	100%	Drawing		-				

Note: Wherever "V" is indicated in column 10 (C), verification of documents to be done at shop during one of the visits.

Annexure – VII

Vendor's Responsibilities

The work to be carried out as per the above scope shall be all in accordance with the requirements, conditions, appendices, etc., stated in the Specification, as completely as if bound herewith. The Contractor shall be responsible for providing all material, equipment and service, which are required to fulfill the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. It is not the intent to specify completely herein, all aspects of design and construction of equipment, nevertheless, the equipment shall conform in all aspects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation, in a manner acceptable to the Purchaser/Owner, who will interpret the meaning of the specification, drawings and shall have a right to reject or accept any work or material which in his assessment is not complete to meet the requirements of this specification and/or applicable international standards.

Bidder is requested to carefully examine and understand the specifications and seek clarifications, if required, to ensure that they have understood the specification. The Bidder's offer should not carry any sections like clarifications, interpretations and / or assumptions. In the event of conflict in interpretation of Technical Specifications vendor may get clarified from purchaser/ owner. However, if the Bidder feels that, in his opinion, certain features brought out in his offer are superior to what has been specified, these may be highlighted separately in the offer.

The Bidder may also make alternate offers provided, such offers are superior in his opinion, to the requirements of these specifications in which case, adequate technical information, operating feed back, etc., are to be enclosed with the offer, to enable the Purchaser/Owner to assess the superiority and reliability of the alternatives offered. In case of each alternative offer, its implications on the performance, guaranteed efficiency, auxiliary power consumption etc., shall be clearly brought out for the Purchaser/Owner to make an overall assessment. In any case, the base offer shall necessarily be in line with the specifications.

In case, all the above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.

Deviations, if any, should be very clearly brought out, otherwise, it will presumed that the Vendor's offer is strictly in line with this specification.

The general terms and conditions, instructions to Bidder and the attachments referred to elsewhere are hereby made part of the tender specifications. The equipment materials and works covered by their specification is subject to all the attachments referred in the specification. The Bidder shall be responsible for all requirements stipulated herein after.

Wherever a material or article is specified or described by the name of a particular brand, manufacturer or vendor, the specific items mentioned shall be understood to be descriptive only and not restrictive. Such description indicates the equipment type, function and quality desired. Other manufacturer's products may be considered provided sufficient information so as to enable the Purchaser/Owner to determine that the products proposed are equivalent to those named.

Not withstanding anything stated above, the Purchaser / Owner reserves the right to assess the bidder's capabilities and capacity of the bidder / his collaborators / licenser / his sub-contractor to perform the contract, should the circumstances warrant such assessment in the overall interest of the Purchaser .The bidder shall provide all necessary data related to sub vendor such as type, design, make, capacity, duty conditions, date of commissioning/operation etc

PRESSURE & DIFFERENTIAL PRESSURE SWITCHES		
1	Application	Pressure vessel and piping.
2	Medium	Crude oil
3	Type	On line – Remote capilliary for Crude oil
4	Accuracy	(+ or -) 1% of FSD
5	Repeatability	(+ or -) 0.5 % of FSD
6	Sensing element type	Diaphragm cum piston or Bellows or capsule
7	Proof pressure	200 % of operating pressure
8	Construction	Weather proof, water tight & dust tight as per IP55 of IS 2147 & Explosion proof – intrinsically safe suitable for Hazardous Area classification as per IS 5572, Gas group II A & II B of IS-2148.
9	Painting	Stoved Enameled anti - corrosive painting or Epoxy powder coated.
10	Switching element	2SPDT
11	Type of contact	Environmentally Sealed micro switch with gold plated contact -auto reset.
12	Contact rating	30 V DC, 1 A mp.
13	Contact Action	Contact to close on increasing or decreasing parameter as per Data Sheet.
14	Cable Entry	1/2" NPT (F) – 2 Nos. with suitable plugs.
15	Terminal strip	To be provided inside the switch enclosure suitable for 2.5 sq.cm wire.Stud type or screw type with pressure plate.
16	Internal wiring	To be provided inside the switch enclosure suitable for 2.5 sq.cm wire.Stud type or screw type with pressure plate.
17	Set Point	Continuously adjustable through out the range with calibrated scale
18	MATERIAL	
19	Case	Die cast Aluminium
20	Pressure port	Stainless steel
21	Sensing element	AISI 316 SS
22	Internal parts	Steel cadmium plated or stainless steel
23	Contact	Steel cadmium plated or stainless steel silver alloy.

TEMPERATURE SWITCHES WITH THERMOWELL		
1	Application	Pressure vessel and piping.
2	Medium	Crude oil
3	Type	Remote - Capillary type
4	Accuracy	(+ or -) 1 % of FSR
5	Repeatability	(+ or -) 1 % of FSR
6	Sensing system	Gas actuated / Mercury filled
7	Proof temperature	200 % of operating temperature
8	Type of sensing element	Diaphragm cum piston or bellows
9	Enclosure protection	Weather proof, water tight & dust tight as per IP55 of IS 2147 & Explosion proof – intrinsically safe suitable for Hazardous Area classification as per IS 5572, Gas group II A & II B of IS-2148.
10	Painting	Stoved Enameled anti - corrosive painting or Epoxy powder coated.
11	Switching element	2 Nos of SPDT
12	Type of contact	Environmentally Sealed micro switch with gold plated contact -auto reset.
13	Contact rating	5A at 240 V AC, 50 Hz or 0.25 A at 220 V DC
14	Contact Action	Contact to close increasing or decreasing parameter
15	Cable entry	3 / 4 " NPT (F)
16	Terminal strip	To be provided inside the switch enclosure suitable To be provided inside the switch enclosure suitable for 2.5 sq mm wire. Stud type or screw type with
17	Internal wiring	Shall be done with 1.5 sqmm PVC wire
18	Thermowell connection for process	M 33 X 2 (M)
19	Dead band / Switching	Fixed minimum
20	Differential Set point	Continuously adjustable through out the range with calibrated scale
21	**MATERIAL**	
22	Body	Die cast Aluminium
23	Sensing element	AISI 316 SS
24	Internal parts	Steel cadmium plated or SS
25	Contact	Silver alloy AISI 316 SS
26	Thermowell	AISI 316 SS

PRESSURE GAUGES - BOURDON TYPE		
1	Reference standard	IS 3624
2	Type	Direct reading
3	Scale	Industrial concentric 270° linear
4	Sensing element	Bourdon for Pressure ranges.
5	Nominal Dial Size	150 mm Circular
6	Accuracy	± 1% of URV (FSD)
7	Over range protection	125% of maximum range.
8	Dial graduation	Graduated in Kg / Sq.cm
9	Zero adjustment	External Micrometer adjustable Pointer (from the front after opening the bezel)
10	Enclosure protection	Weather proof , water tight & dust tight IP 55 of IEC - 529 / IS-2147 (IS – 12063)
11	Identification	Separate SS name plate with Tag No. & Service legend attached to the
12	**MATERIAL**	
13	Case	Stainless Steel (SS 304)
14	Bezel	AISI 316 SS
15	Bourdon / Diaphragm/ Bellows / Capsule	AISI 316 SS
16	Movement assembly	AISI 304 SS
17	Window	Shatter proof glass.
18	Blow out disc	Neoprene
19	Socket	AISI 316 SS

PRESSURE GAUGES - CHEMICAL SEAL DIAPHRAGM TYPE		
1	Reference standard	IS 3624
2	Type	Direct reading
3	Scale	Industrial concentric 270 Degree linear
4	Sensing element	Diaphragm with chemical seal
5	Nominal Dial size	150 mm Circular
6	Accuracy	± 1% of FSD
7	Over range protection	125% of maximum range.
8	Dial graduation	Graduated in Kg / Sq.cm
9	Zero adjustment	External Micrometer adjustable Pointer (from the front after opening the bezel)
10	Enclosure protection	Weather proof , water tight & dust tight IP 55 of IEC - 529 / IS-2147 (IS – 12063)
11	Identification	Separate SS name plate with Tag No. & Service legend attached to the gauge
12	**MATERIAL**	
13	Case	Stainless Steel (SS 304)
14	Bezel	AISI 316 SS
15	Bourdon	AISI 316 SS
16	Movement assembly	AISI 304 SS
17	Window	shatter proof glass.
18	Blow out disc	Neoprene
19	Socket	AISI 316 SS
20	Diaphragm Chamber Sensing Element	AISI 316 SS Teflon coated / Sheathed and welded type diaphragm
21	Top Chamber	AISI 304 SS
22	Bottom Chamber	AISI 316 SS Teflon coated / Sheathed
23	Sealing Liquid	Silicon oil.
24	Capillary	SS 316 with SS 304 armoring of 5 meter length

DIFFERENTIAL PRESSURE GAUGE		
1	Reference standard	IS 3624
2	Type	Direct Reading
3	Scale	Linear, 270 deg arc, graduate in metric units.
4	Sensing element	Bourdon for high pressure Diaphragm/Bellow for low pr.
5	Nominal Dial size	150 mm Circular
6	Accuracy	± 2% of FSD
7	Over range protection	The + ve and - ve side of the presure chamber shal be unilaterally over load proof 1,5 ime the full scale value Max 25 Kg/Sq.cm.
8	Dial graduation	
9	Zero / Span adjustment	External Micrometer adjustable Pointer (from the front after opening the bezel)
10	Enclosure protection	Weather proof, water tight and dust tight to IP 55 of IEC – 529 / IS 2147(IS 12063)
11	Identification	Separate SS name plate with Tag No. & Service legend attached to the gauge
12	**MATERIAL**	
13	Case	Stainless Steel (SS 304)
14	Bezel	AISI 316 SS
15	Diaphragm / Bourdon / Bellows	AISI 316 SS
16	Movement assembly	304SS
17	Window	Shatter proof glass
18	Blow out disc	Neoprene
19	Measuring chamber	Stainless steel

TEMPERATURE GAUGE WITH THERMOWELL		
1	Reference standard	BS 5235 / SAMA
2	Type	Remote capillary type.
3	Scale	Linear, 270 deg arc, graduate in metric units.
4	Sensing Element	Liquid / Vapour / Gas filled
5	Nominal Dial size	150 mm Circular
6	Accuracy	± 1 % of FSD
7	Over range protection	125% of max range.
8	Dial Graduation	Graduated in Deg.C.
9	Zero Adjustment	External Micrometer adjustable Pointer (from the front after opening the bezel)
10	Enclosure protection	Weather proof, water tight & dust tight. IP 55 of IEC 529 / IS - 2147 (IS 12063).
11	Identification	Separate SS name plate with Tag No. & Service legend attached to the gauge
12	**MATERIAL**	
13	Case	Stainless Steel (SS 304)
14	Bezel	AISI 316 SS
15	Bourdon	Chrome moly steel or AISI 316 SS
16	Movement assembly	AISI 304 SS
17	Window	Shatter proof glass .
18	**Thermowell**	
19	Thermowell specification	As per ASME performance test code
20	Thermowell	AISI 316 SS
21	Thermowell bore dia	Suitable to accommodate sensing bulb
22	Thermowell process connection	M33 X 2 (M)
23	Thermowell type	Bar stock / tapered
24	**Bulb**	
25	Bulb and stem	AISI 316 SS
26	Bulb OD	To suit thermowell ID
27	Bulb to thermowell	1/2" NPT(M)
28	**Capillary**	
29	Capillary	AISI 304 with SS flexible armouring & PVC covering over armour.
30	Capillary size	1.5 mm dia
31	Capillary sheath	4.5 mm OD SS
32	Capillary length	5 metres
33	Test pressure	200 Kg / sqcm
34	Response time	Not more than 15 secs. (Without thermowell)

List of C&I Items with QP

Note: Purchase/MM shall attach the following applicable QPs along with the Specification.

SL. No.	Description	QP Number
01	Pressure gauges.	QA:CI:STD:QP:01
02	Temperature gauges	QA:CI:STD:QP:02
03	DP gauges	QA:CI:STD:QP:01
04	Pressure switches	QA:CI:STD:QP:06
05	Temperature switches	QA:CI:STD:QP:18
06	DP switches	QA:CI:STD:QP:06
07	Pneumatic actuator - open / close type	CI:QA:SUDAN:CQP:02
08	Electric actuator regulating	QA:CI:STD:QP:13
09	Flame scanner shielded cable	CI:QA:SUDAN:CQP:04

BHARAT HEAVY ELECTRICALS LIMITED / TIRUCHIRAPPALLI
CONTROLS AND INSTRUMENTATION/QA/FB

STANDARD QUALITY PLAN
FOR
PRESSURE GAUGE (BOURDON, DIAPHRAGM & DRAFT)

REV	DATE	PREPARED	REVIEWED	APPROVED	REVISION HISTORY
00	----	--- Sd ---	--- Sd ---	--- Sd ---	Initial release.
01	----	--- Sd ---	--- Sd ---	--- Sd ---	General revision.
02	03.06.93	--- Sd ---	--- Sd ---	--- Sd ---	Converted to 9 column QP.
03	16.06.97	--- Sd ---	--- Sd ---	--- Sd ---	Format revised.
04	21.03.02	--- Sd ---	--- Sd ---	--- Sd ---	Dept. name changed, CTQ requirements added & General revision.
05	08.01.04	RM.VAIRAVAN	N.SRIDHAR	S.SOMASUNDARAM	Revised to include the comments /Feedback of internal discussion / Vendors meet.

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	TYPE OF CHECK	QUANTUM OF CHECK	REF.DOC. & ACCEPTANCE STANDARD	FORMAT OF RECORD	AGENCY	REMARKS
A.	**RAW MATERIAL & BOUGHTOUT ITEMS INSPECTION**							
1.	Raw Material For							
	a) Sensing ⇒ element, (Bourdon/ Diaphram/ Bellow/Capsule)	Material composition	CHEM	One sample per lot.	Manufacturer's standard.	IQR	MQCD/ Lab.	
	b) Movement ⇒ assembly	Material composition	CHEM	- do -	- do -	- do -	- do -	
	c) Socket ⇒	Material composition	CHEM	- do -	- do -	- do -	- do -	
2.	Case and Bezel	a) Dimension	MEAS	100%	- do -	- do -	MQCD	
		b) Finish	PHYS	- do -	- do -	- do -	- do -	
3.	Gasket	a) Material composition	CHEM	One sample per lot.	- do -	- do -	- do -	
		b) Dimension	MEAS	100%	- do -	- do -	- do -	
4.	Pointer	a) Dimension	MEAS	- do -	- do -	- do -	- do -	
		b) Shape	PHYS	- do -	- do -	- do -	- do -	
B.	**IN PROCESS INSPECTION**							
1.	Formation of bourdon & welding with ⇒	a) Dimension	MEAS	- do -	Manufacturer's standard.	- do -	- do -	

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	TYPE OF CHECK	QUANTUM OF CHECK	REF.DOC. & ACCEPTANCE STANDARD	FORMAT OF RECORD	AGENCY	REMARKS
	Socket				(Temperature & duration to be monitored.)			
	⇒	b) Stress relieving.	MECH	100%	Manufacturer's standard. (Temp & duration to be monitored.)	IQR	MQCD	
	⇒	c) Leakage(Hydro test/Helium test)	MECH	- do -	Manufacturer's standard	- do -	- do -	
2.	Assembly	a) Range , Connection size and dial size	MECH	- do -	Manufacturer's standard, IS 3624/EN837-1,2,3	- do -	- do -	
C.	**FINISHED PRODUCT INSPECTION**							
1	Routine Tests ⇒	a) Physical & dimensional check including scale marking & tag details.	PHYS	100%	Manufacturer's Standard, IS 3624/EN837-1,2,3, Approved drawing and Data sheet	- do -	- do -	**CHP**
	⇒	b) Calibration test (accuracy) at minimum 5 points over the range before & after over Pressure test.	MEAS & MECH	- do -	- do -	- do -	- do -	**CHP**

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	TYPE OF CHECK	QUANTUM OF CHECK	REF.DOC. & ACCEPTANCE STANDARD	FORMAT OF RECORD	AGENCY	REMARKS
	⇒	c) Over range protection test.	PHYS & MECH	- do -	- do -	- do -	- do -	**CHP**
	⇒	d) Range.	MEAS	100%	Manufacturer's Standard, IS 3624/EN837-1,2,3, Approved drawing and Data sheet	IQR	MQCD	**CHP**
	⇒	e) Dial size.	MEAS	- do -	- do -	- do -	- do -	**CHP**
	⇒	f) Zero adjustment.	PHYS	- do -	- do -	- do -	- do -	**CHP**
	⇒	g) Blow out disc.	PHYS	- do -	- do -	- do -	- do -	**CHP**
	⇒	h) Mounting , entry and Process Connection	PHYS	- do -	- do -	- do -	- do -	**CHP**
	⇒	j) Over pressure test	MECH	- do -	- do -	- do -	- do -	**CHP**
		j) Check CTQ characters indicated under Raw material & In process inspection for verification of records only.	PHYS	- do -	- do -	- do -	- do -	**CHP**
		k) Bouardon Arc dia	MEAS	As Per Sampling Plan – Note – G	As Per Relevant Standard	- do -	- do -	**CHP**

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	TYPE OF CHECK	QUANTUM OF CHECK	REF.DOC. & ACCEPTANCE STANDARD	FORMAT OF RECORD	AGENCY	REMARKS
		l) Hysterisis & Repeatability.	MECH	100%	IS 3624/ EN837-1,2,3/BS 1780	- do -	- do -	**CHP**
2	Type Tests	a) Enclosure protection.	ENVI	One of design.	IS 12063, IS13947-1, IEC 529	T.C	MQCD / Lab	**CHP-** TC Verification
		b) Endurance test.	MECH	- do -	IS 3624/ EN837-1,2,3	- do -	MQCD	- do -
		d) Thermal stability test.	ENVI	- do -	NOTE “F ”	- do -	- do -	- do -
		e) Vibration test	MECH	- do -	EN837-1,2,3	- do -	- do -	- do -

D. NOTES:

1. **LEGEND**

MQCD : MANUFACTURER'S QUALITY CONTROL DEPARTMENT;
MECH : MECHANICAL; CHEM : CHEMICAL;
ENVI :ENVIRONMENTAL LGB : LOG BOOK;
T.C. : TEST CERTIFICATE; PHYS : PHYSICAL;
MEAS : MEASUREMENT;
⇒ : CRITICAL TO QUALITY POINTS;
IQR : INTERNAL QUALITY REPORT;
LAB : LABORATORY (GOVT . APPROVED / NABL ACCREDITED)
CHP : CUSTOMER HOLD POINT - INSPECTION BY BHEL.

2. All testing facilities shall be arranged by the vendor at their works. Tests for which facilities are not available & those tests marked test lab in agency column above are to be carried out at recognised national test houses like ETDC/ CIL / NPL / ERTL ETC at vendor's cost.
3. Through logbooks / any other documents available at the vendor's works, it shall be possible to corelate the finished product with raw material and inprocess stage checks / inspection carried out.
4. All measuring and testing instruments shall be periodically calibrated from recognised test houses and valid certificates made available during inspection.
5. Test certificates for routine & type tests are to be furnished by the vendor. Type test certificate shall not be earlier than 5 years from the date of Purchase enquiry. If any changes are made in the design, material and process, the type tests shall be repeated, irrespective of the validity of existing type test certificate.
6. Vendor to give tentative inspection programme in advance and confirm exact date two weeks in advance for arranging inspection by BHEL or by its authorised Inspection agency
7. Packing shall be as per the 'PACKING PROCEDURE' indicated in the Specification

E. REFERENCE STANDARDS: (For The Indicated Standards refer The Latest Version)

BS 1780 : Specification for Bourdon tube Pressure and vacuum gauge
IEC:529 : Specification for degrees of protection provided by enclosure.
IS 3624 : Specification for pressure and vacuum gauges.
IS4905 : Methods for Random Sampling
IS12063: Classification of Degrees of protection provided by enclosures for electrical equipment
IS 13947– 1: Specification For General Rules for Low Voltage Switch Gear.

F. THERMAL STABILITY TEST:

A cyclic temperature test shall be performed in a suitable test chamber by Elevating the temperature to the maximum rated temperature within two hours The instrument case shall be held at the maximum temperature for 10 hours. The case temperature shall then be lowered to the specified minimum Temper ature over a 2 hours period. The minimum temperature shall also be held for 10 hours**. 2 Cycles at Third Party Lab (Govt. Appd / NABL Accrediated) or 5 Cycles at MQCD is acceptable.** Maximum & minimum temperatures are as per Manufacturer's catalogue. At the end of this period, there shall be no visible deterioration of the gaskets, seals, protective coating nor any significant distortion of the case.

G. SAMPLING PLAN FOR INSPECTION:

a) As Per IS 4905 or 10% of offered quantity as per the discretion of the inspector.
b) If non-conformance is observed on one number in any character, then inspection shall be carried out on all 100%.

BHARAT HEAVY ELECTRICALS LIMITED / TIRUCHIRAPPALLI
CONTROLS AND INSTRUMENTATION/QA/FB

STANDARD QUALITY PLAN FOR TEMPERATURE GAUGE

REV	DATE	PREPARED	REVIEWED	APPROVED	REVISION HISTORY
00	—-	--- Sd ---	--- Sd ---	--- Sd ---	Initial release.
01	----	--- Sd ---	--- Sd ---	--- Sd ---	General revision.
02	03.06.93	--- Sd ---	--- Sd ---	--- Sd ---	Converted to 9 column qp.
03	16.06.97	--- Sd ---	--- Sd ---	--- Sd ---	Format revised.
04	21.03.02	--- Sd ---	--- Sd ---	--- Sd ---	Dept. name changed, CTQ requirements added & General revision.
05	08.01.04	RM.VAIRAVAN	N.SRIDHAR	S.SOMASUNDARAM	Revised to include the comments /Feedback of internal discussion / Vendors meet.

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	TYPE OF CHECK	QUANTUM OF CHECK	REF.DOC. & ACCEPTANCE STANDARD	FORMAT OF RECORD	AGENCY	REMARKS
A.	**RAW MATERIAL & BOUGHTOUT ITEMS INSPECTION**							
1	Raw Material For a) Sensing element, (Bourdon / Diaphram) ⇒	a) Material composition.	CHEM	One sample per lot.	Manufacturer's standard	IQR	MQCD/ Lab	
	b) Movement assembly ⇒	Material composition	CHEM	- do -	- do -	- do -	- do -	
	c) Socket ⇒	Material composition	CHEM	- do -	- do -	- do -	- do -	
2.	Case and Bezel	a) Dimension	MEAS	100%	- do -	- do -	MQCD	
		b) Finish	PHYS	- do -	- do -	- do -	- do -	
3.	Gasket	c) Material Composition	CHEM	One sample per lot.	- do -	- do -	- do -	
		b) Dimension	MEAS	100%	- do -	- do -	- do -	
4.	Pointer	a) Dimension	MEAS	- do -	- do -	- do -	- do -	
		b) Shape	PHYS	- do -	- do -	- do -	- do -	
5	Thermowell	a) Material composition.	CHEM	One sample per lot.	- do -	- do -	MQCD/ Lab	

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	TYPE OF CHECK	QUANTUM OF CHECK	REF.DOC. & ACCEPTANCE STANDARD	FORMAT OF RECORD	AGENCY	REMARKS
		a) Dimension	MEAS	100%	Manufacturer's standard.	IQR	MQCD	
6	Capillary/Bulb	a) Leak tightness.	PHYS	100%	- do	- do	MQCD	Pressure Test.
B.	**IN PROCESS INSPECTION**							
1	Forming Bourdon & Welding with Socket	a) Dimension	MEAS	100%	Manufacturer's standard. (Temperature & duration to be monitored.)	IQR	MQCD	
	⇒	b) Stress relieving.	MECH	- do -	- do -	- do -	- do -	
	⇒	c) Leakage (Hydro test/Helium test)	MECH	- do -	Manufacturer's standard	- do -	- do -	
2	Machining of Thermowell (Turning, boring Threading, Finishing & buffing)	a) Dimension	MEAS	- do -	Specification; PO & Approved drawing	- do -	- do -	
		b) Surface finish	VISU	- do -	- do -	- do -	- do -	
	⇒	c) Concentricity	VISU	- do -	- do -	- do -	- do -	
		d) Thickness	MEAS	- do -	- do -	- do -	- do -	
3	Assembly	a) Pointer motion.	PHYS	- do -	Manufacturer's standard	- do -	- do -	

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	TYPE OF CHECK	QUANTUM OF CHECK	REF.DOC. & ACCEPTANCE STANDARD	FORMAT OF RECORD	AGENCY	REMARKS
C.	**FINISHED PRODUCT INSPECTION**							
01	Routine Test ⇒	a) Physical and dimensional check including process connection for gauge and thermowell, scale marking and Tag details.	PHYS	100%	Manufacturer's Standard, BS 5235/EN837-1,2,3, Approved Drawing and Data sheet	IQR	MQCD	**CHP** (IBR FORM IIIC where required shall be submited for thermowell)
	⇒	b) Calibration test (accuracy) at minimum 5 points over the range before & after over Pressure test.	MEAS & MECH	- do -	Manufacturer's Standard, BS 5235/EN837-1,2,3, Approved Drawing and Data sheet	- do -	- do -	**CHP**
		c) Hydraulic Test for Thermowell.	MECH	- do -	- do -	- do -	- do -	**CHP**
		d) Response time test.	THER	- do -	Refer Note:F	- do -	- do -	**CHP**
	⇒	e) Range.	MEAS	- do -	- do -	- do -	- do -	**CHP**
	⇒	f) Dial size.	MEAS	- do -	- do -	- do -	- do -	**CHP**
	⇒	g) Mounting , entry and Process Connection	PHYS	- do -	- do -	- do -	- do -	**CHP**

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	TYPE OF CHECK	QUANTUM OF CHECK	REF.DOC. & ACCEPTANCE STANDARD	FORMAT OF RECORD	AGENCY	REMARKS
		h) check CTQ characters indicated under Raw material & In process inspection for verification of records only.	PHYS	100%	Manufacturer's Standard, BS 5235/EN837-1,2,3, Approved Drawing and Data sheet	IQR	MQCD	**CHP**
		i) Hysterisis & Repeatability.	MECH	- do -	- do -	- do -	- do -	**CHP**
2.	Type Tests.	a) Enclosure protection.	MECH	One of design	IEC 529 / IS 12063/IS 13947-1 Specification , PO , BS 5235 & drawing	T.C	MQCD/ Lab	**C H P** Verification of TC .
		b). Over Temperature stability Test.	MECH	- do -	- do -	- do -	- do -	
		c). Vibration test.	MECH	- do -	EN837-1,2,3	- do -	- do -	
		d). Ambient temperature compensation test.	THER	- do -	Refer Note F	- do -	- do -	

D. NOTES :

1. MQCD : MANUFACTURER'S QUALITY CONTROL DEPARTMENT;
   MECH : MECHANICAL; CHEM : CHEMICAL;
   VISU : VISUAL; THER : THERMAL;
   SPEC : SPECIFICATION; LGB : LOG BOOK;
   T.C. : TEST CERTIFICATE; MEAS : MEASUREMENT;
   PHYS : PHYSICAL;
   IQR : INTERNAL QUALITY REPORT
   P.O : PURCHASE ORDER;
   LAB : LABORATORY (GOVT. APPROVED/ NABL ACCREDITED)
   CHP : CUSTOMER HOLD POINT - INSPECTION BY BHEL.

2. All testing facilities shall be arranged by the vendor at their works. Tests for which facilities are not available & those tests marked test lab in agency column above are to be carried out at recognized national test houses like ETDC / CIL / NPL /ERTL etc.. at vendor's cost.

3. Through logbooks/any other documents available at the vendor's works, it shall be possible to correlate the finished product with raw material and in process stage checks/inspection carried out.

4. All measuring and testing instruments shall be periodically calibrated from recognized test houses and certificates made available during inspection for verification.

5. Test certificates for routine & type tests are to be furnished by the vendor. Type test certificate shall not be earlier than 5 years from the date of Purchase enquiry. If any changes are made in the design, material and process, the type tests shall be repeated, irrespective of the validity of existing type test certificate.

6. Vendor to give tentative inspection program in advance and confirm exact date two weeks in advance for arranging inspection by BHEL or by the authorized inspection agency.

7. Packing shall be as per the ' PACKING PROCEDURE ' indicated in the Specification.

E.REFERENCE STANDARDS: (For The Indicated Standards Refer The Latest Version)

1) **BS 5235** : Dial type thermometer.
2) **IEC 529** : Specification for degrees of protection provided by enclosure.
3) **IS4905** : Methods for Random Sampling
4) **IS 12063** : Specification on degrees of protection offered by enclosure.

F.TYPICAL PROCESS & TEST REQUIREMENTS :

1) Response time test : Time taken to reach 63% of the temperature difference between bath temperature and room temp. shall not exceed 15 seconds, when the bulb is directly immersed in a well stirred liquid bath, and shall not exceed 50 seconds when used with a thermowell.

2) Ambient temperature compensation test: The thermometer case (along with capillary in the case of capillary thermometers) shall be kept in an environment chamber, where the temperature shall be varied from 0 to 60°C. keeping the thermometer bulb in a constant temperature bath, the resultant difference in gauge reading due to temp. variation in the chamber shall not exceed the specified accuracy limits.

G. SAMPLING PLAN FOR INSPECTION:

a) As Per IS 4905 or 10% of offered quantity as per the discretion of the inspector.
b) If non-conformance is observed on one number in any character, then inspection shall be carried out on all 100%.

BHARAT HEAVY ELECTRICALS LIMITED

TIRUCHIRAPPALLI

QUALITY ASSURANCE

CONTROLS AND INSTRUMENTATION

STANDARD QUALITY PLAN

FOR

TEMPERATURE SWITCHES

REV	DATE	PREPARED	REVIEWED	APPROVED	REVISION HISTORY
00	17.01.90	--- Sd ---	--- Sd ---	--- Sd ---	Initial release.
01	16.06.97	--- Sd ---	--- Sd ---	--- Sd ---	Format revised
02	21.03.02	A.J.OMPRAKASH	R.VARADARAJAN	G.MATHIYALAGAN	Department name changed, CTQ requirements added & General revision.

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	TYPE OF CHECK	QUANTUM OF CHECK	REF. DOC & ACCEPTANCE STD	FORM OF RECORD	AGENCY	REMARKS
A)		**FINISHED PRODUCT INSPECTION**						
01	ROUTINE TEST	1) PHYSICAL & DIMENSIONAL CHECK FOR INSTRUMENTS & THERMOWELL	PHYS & MEAS	100 %	P.O ; SPEC & MFR'S STD	TC	MQCD	**C H P**
		♦2) PROCESS CONNECTON	PHYS					
		♦3) CALIBRATION (ACCURACY) AT 4 POINTS OVER THE RANGE	MECH					
		4) OVER-TEMP. TEST	THER					
		5) INSULATION RESISTANCE TEST (INSULAT - ION RESISTANCE SHOULD MORE THAN 10 MEGA OHM - THERE SHALL BE NO FLASH OVER)	ELEC					
		6) HIGH VOLTAGE TEST AT 1.5 KV FOR 1 MINUTE	ELEC					
		♦7) CONTACT TYPE, RATING AND ACTION	PHYS					
		♦8) SET POINT	PHYS					
		♦9) PULSATION DAMPER / SNUBBER	PHYS					
		♦10) PROOF PRESSURE TEST	MEAS					
		♦11) CHECK FOR SWITCHING DIFFERENTIAL (DEAD BAND) AND REPEATABILITY	MEAS					
		♦12) VALVE MANIFOLD	PHYS					
02	TYPE TEST	♦ ENCLOSURE PROTECTION TEST	ENVI	ONE OF DESIGN	SPEC; IS 13947 Pt 1 & NEMA	TEST REPORT	TEST LAB	**C H P** – For verification of type test certificates

♦ : CRITICAL TO QUALITY (CTQ) POINTS

B) NOTES :

i) MQCD : Manufacturer's quality control dept;
PHYS : Physical; MECH : Mechanical;
MEAS : Measurement; ELEC : Electrical;
ENVI : Environmental ; THER : Thermal;
SPEC : Specification; TC : Test Certificate;
MFR'S STD: Manufacturer's Standard; STD : Standard:
PO : Purchase Order; TEST LAB : Test laboratory:
NEMA : National Electrical Manufactures Association;
♦ : Critical To Quality (CTQ) Points;
CHP : Customer Hold Point - Inspection by BHEL.

ii) All testing facilities shall be arranged by the vendor at their works. Test's for which facilities are not available & Those tests marked as test lab in agency column above are to be carried out at recognised national test houses like ETDC / CIL / NPL / ERTL etc: at vendor's cost.

iii) Through log books/any other documents available at the vendor's works, it shall be possible to corelate the finished product with raw material & in – process stage checks/ inspection carried out.

iv) All measuring & testing instruments shall be periodically calibrated from recoginsed test house and certificates made available during inspection for verification.

v) Test certificate for Routine / Type test are to be furnished by the vendor. The type test certificate shall not be earlier than 5 years from the date of purchase enquiry.

vi) Vendor to give tentative inspection programme in advance & confirm exact date three weeks in advance for arranging BHEL's inspection.

vii) Packing shall be as per the " PACKING PROCEDURE " indicated in the Specification.

C) REFERENCE STANDARD (FOR THE INDICATED STANDARDS REFER THE LATEST VERSION)

1) IS 13947 Pt I : General rules for low voltage switchgear (Degrees of enclosure protection offered by enclosures)

2) NEMA : Nema standard "Enclosures for electrical equipment (1000V max.)".

D) SAMPLING PLAN FOR INSPECTION:

(a) 10% of offered quantity subject to a maximum of five numbers.

(b) If non-conformance is observed on one number in any character, then inspection shall be carried out on all 100%.

BHARAT HEAVY ELECTRICALS LIMITED / TIRUCHIRAPPALLI

CONTROLS AND INSTRUMENTATION/QAC/FB

CONTRACT QUALITY PLAN

FOR

PNEUMATIC ACTUATORS (POWER CYLINDER)

(OPEN / CLOSE AND REGULATING TYPE)
(BOUGTOUT ITEMS)

KOSTI SUDAN 4 X 125 MW

NATIONAL ELECTRICITY CORPORATION, SUDAN

REV	DATE	PREPARED	REVIEWED	APPROVED	REVISION HISTORY
00	09/05/06	Sd/-	Sd.-	Sd.-	Initial Release
01	20/11/06	Sd/-	Sd.-	Sd.-	Revised as per IO/BHEL email dt. 16/11/06.
02	05/02/07	RM.VAIRAVAN	N.SRIDHAR	S.SOMASUNDARAM	General revisions

SL. NO	COMPONENT & OPERATION	CHARACTERISTICS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOC. & ACCEPTANCE STANDARD	FORMAT OF RECORD	AGENCY			REMARKS
							M	B	C	
A.	RAW MATERIALS & BOUGHT ITEMS INSPECTION									
1.	Cylinder	a) Material	CHEM	OSPL	Specification & BS 970	LGB	P	-	-	
		b) Dimension	MEAS	100%	Mfr standard	- do -	P	-	-	
		c) Finish	MEAS	100%	- do -	- do -	P	-	-	
		d) Pressure resistance test	PHYS	OSPL	JIS B8377	LGB	P	V		
2.	Piston rod, Cylinder caps, Piston ring	a) Material	CHEM	OSPL	Specification, BS970	LGB	P	-	-	
		b) Dimension	MEAS	- do -	Mfr standard	- do -	P	-	-	
3.	" O " ring	a) Material	CHEM	- do -	Specification	- do -	P	-	-	
		b) Dimension	MEAS	- do -	Mfr standard	- do -	P	-	-	
		c) Hardness	MEAS	- do -	- do -	- do -	P	-	-	
4.	Housing & cover	a) Material	CHEM	- do -	- do -	- do -	P	-	-	
		b) Dimension	MEAS	- do -	- do -	- do -	P	-	-	
5.	Air filter regulator	a) Type & Make	PHYS	- do -	Specification & data sheet	- do -	P	-	-	
		b) Pressure gauge range	PHYS	- do -	- do -	- do -	P	-	-	
		c) Dimension of process connection	MEAS	- do -	- do -	- do -	P	-	-	
		d) Filter size in Microns	PHYS	- do -	do –	- do -	P	-	-	
6.	Limit switches	a) Make &Type number	PHYS	100%	Specification & Data sheet	LGB	P	-	-	
		b) Functional check	ELEC	- do -	- do -	- do -	P	-	-	
7.	Air lock relay	a) Functional check	PHYS	- do -	- do -	- do -	P	-	-	
		b) Make, Type number	PHYS	- do -	- do -	- do -	P	-	-	
8.	Solenoid valve (only for open / close)	a) Make &Type number	PHYS	- do -	- do -	- do -	P	-	-	
		b) Class of insulation	PHYS	- do -	- do -	- do -	P	-	-	
		c) Functional check	ELEC& MECH	- do -	- do -	- do -	P	-	-	
9.	Positioner (Applicable only for regulating power cylinder)	Make &Type	VISU	- do -	Specification & Data Sheet	- do -	P	-	-	Performance to be checked during complete assembly testing.

P – PERFORM; V – VERIFICATION BY BHEL; W – WITNESS BY BHEL; M – MANUFACTURER; B – BHEL/TPI; C – CUSTOMER (NEC, SUDAN)

SL. NO	COMPONENT & OPERATION	CHARACTERISTICS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOC. & ACCEPTANCE STANDARD	FORMAT OF RECORD	AGENCY			REMARKS
							M	B	C	
10	Position feedback transmitter (applicable For regulating type only)	a) Type b) Functional check c)H.V. Test (500 V AC for 1 Min.)	VISU MEAS ELEC	100% 100% OSPL	Specification, Data sheet, Mfr's Procedure	LGB	P	V	-	Performance to be checked during complete assy testing.
11	Wiring connection	a) continuity	ELEC	100%	Drawing	-do-	P	-	-	
B. INPROCESS INSPECTION										
1.	Complete Assembly.	a) Functional check	PHYS & ELEC	100%	Specification, Data sheet	LGB	P	-	-	
C. FINISHED PRODUCT INSPECTION										
1.	Routine Tests	a) No load operation test	PHYS	100%	JIS B 8377,	T.R	P	W		
		b) Physical Verification of Mounting & Finish.	PHYS	- do -	Specification , PO & Data sheet.	- do -	P	W		
	⇒	c) Dimensional Check including process connections	MEAS	- do -	Specification & Drawing	- do -	P	W		
		d) Verification of Type Make & components	PHYS	- do -	Specification, Drawing	- do -	P	W		
		e) Stroking length & time.	MEAS	- do -	- do -	- do -	P	W		
		f) Provision of accessories like linkage, mechanism	PHYS	- do -	Data sheet	- do -	P	W		
	⇒	g) Performance test (Sensitivity, Hysterisis, calibration, Accuracy, Repeatability, Action of driving equipment)	MECH	- do -	Specification	- do -	P	W		
	⇒	h) Check operation of stay put device	VISU	100%	Specification Data sheet	T.R	P	W		
	⇒	i) Solenoid valve – coil type & duty cycle	VISU	- do -	Specification Appd. Data sheet	- do -	P	W		Applicable for open / close type
	⇒	j) Air filter – filter element size in microns	VISU	- do -	- do -	- do -	V	V		Verification of TR
2.	Type Tests	a) Load operation test.	PHYS	One of design	JIS B 8377	T.R / T.C	V	V		
		b) Durability test.	PHYS	- do -	- do -	- do -	V	V		

P – PERFORM; V – VERIFICATION BY BHEL; W – WITNESS BY BHEL; M – MANUFACTURER; B – BHEL/TPI; C – CUSTOMER (NEC, SUDAN)

D.NOTES:

1. LEGEND :

PHYS	:	Physical	CHEM	:	Chemical
ELEC	:	Electrical	MECH	:	Mechanical
MEAS	:	Measurement	VISU	:	Visual
TC	:	Test certificate	OSPL	:	One sample per lot
LGB	:	Log Book	Mfr's	:	Manufacturer's
TR	:	Test Report			

⇒ - CRITICAL TO QUALITY POINTS;

2. All test facilities shall be arranged by the vendor at their works. Tests for which facilities are not available are to be carried out at recognized national test houses like ETDC/CIL/NPL/ERTL/NABL accredited lab at vendor's cost.
3. Through logbooks / any other documents available at the vendor's works, it shall be possible to correlate the finished product with raw material and in process stage checks / inspection carried out.
4. All measuring and testing instruments shall be periodically calibrated from recognized test houses and certificates made available during Inspection.
5. Test certificates for routine & type test to be furnished by the vendor.
6. Vendor to give tentative inspection program in advance and confirm exact date three weeks in advance for arranging BHEL inspection.
7. Packing shall be as per the ' PACKING PROCEDURE ' as indicated in specification.
8. **Inspection / verification will be done by BHEL / Authorised Inspection Agency.**

E. REFERENCE STANDARDS:

(For Indicated Standards Refer the Latest Version)

1. JIS B 8377 : Specification for Pneumatic cylinder.
2. BS 970 : Specification for Wrought steel for Mechanical end
3. IS 4905 : Method of random sampling.

SAMPLING PLAN FOR INSPECTION:

1. As per 4905 or 20% of offered quantity subject to a minimum of two nos. per model at the discretion of Inspector.
2. If non-conformance is observed on one sample in any character, then inspection shall be carried out on all 100%.

SUDANCQP02.DOC

BHARAT HEAVY ELECTRICALS LIMITED / TIRUCHIRAPPALLI
CONTROLS AND INSTRUMENTATION/QA/FB

STANDARD QUALITY PLAN
FOR
ELECTRIC ACTUATOR
(OPEN / CLOSE AND REGULATING)

REV	DATE	PREPARED	REVIEWED	APPROVED	REVISION HISTORY
00	06.08.90	--- Sd ---	--- Sd ---	--- Sd ---	Initial release.
01	16.06.97	--- Sd ---	--- Sd ---	--- Sd ---	Format revised
02	21.03.02	--- Sd ---	--- Sd ---	--- Sd ---	Department name changed, CTQ requirements added & General revision.
03	08.01.04	RM.VAIRAVAN	N.SRIDHAR	S.SOMASUNDARAM	Revised to include the comments /Feedback of internal discussion.

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	TYPE OF CHECK	QUANTUM OF CHECK	REF.DOC. & ACCEPTANCE STANDARD	FORMAT OF RECORD	AGENCY	REMARKS
A.	**FINISHED PRODUCT INSPECTION**							
1.	Routine Tests	a) Over all and mounting dimension.	MEAS	100%	P.O , Specification , IS 325 & IS 9334	T.C	MQCD	**C H P**
		b) Name plate verification for model no, make & type.	VISU	100%	P.O , Specification , IS 325 & IS 9334	T.C	MQCD	**C H P**
		c) Verification of paint shade thickness & finish	VISU & MEAS	- do -	- do -	- do -	- do -	**C H P**
	⇒	d) Limit / Torque switches– Rating & contact combination.	PHYS	- do -	- do -	- do -	- do -	**C H P**
		e) Manual operation	MECH	- do -	- do -	- do -	- do -	**C H P**
		f) Checking the operation of limit switches, torque switches	MECH	- do -	- do -	- do -	- do -	**C H P**
		g) Oil / Grease leakage	MECH	- do -	- do -	- do -	- do -	**C H P**
		h) Direction of rotation.	VISU	- do -	- do -	- do -	- do -	**C H P**

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	TYPE OF CHECK	QUANTUM OF CHECK	REF.DOC. & ACCEPTANCE STANDARD	FORMAT OF RECORD	AGENCY	REMARKS
		i) Dielectric test for assembled actuator.	ELEC	100%	2 KV for 1 Minute- No flash over	T.C	MQCD	**C H P**
		j) Functional test for electronic positioner (along with actuator). – Applicable for Regulating Actuator.	ELEC	- do -	Purchase Order , Specification , IS 325 & IS 9334	- do -	- do -	**C H P**
		k) Measurement of operating time.	PHYS	- do -	- do -	- do -	- do -	**C H P**
	⇒	l) Verification of name plate for Motor 1. Class of insulation 2. Motor duty rating.	VISU	- do -	- do -	- do -	- do -	**C H P**
	⇒	m) Actuator bore	MEAS	- do -	- do -	- do -	- do -	**C H P**
	⇒	n) Total turns	MEAS	- do -	- do -	- do -	- do -	**C H P**
		o) Accessories.	PHYS	- do -	- do -	- do -	- do -	**C H P**
	⇒	p) Secondary gear box						
		1. Self locking worm gears	PHYS	100%	Purchase Order , Specification , Data sheet, IS 325 &	T.C	MQCD	**C H P**

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	TYPE OF CHECK	QUANTUM OF CHECK	REF.DOC. & ACCEPTANCE STANDARD	FORMAT OF RECORD	AGENCY	REMARKS
					IS 9334			
		2. Key way dimensions	MEAS	100%	Purchase Order , Specification , Data sheet, IS 325 & IS 9334	T.C	MQCD	**C H P**
		3. Splined / removable bush & dimensions	PHYS & MEAS	- do -	- do -	- do -	- do -	**C H P**
	⇒	q) Minimum starting torque	MECH	- do -	- do -	- do -	- do -	**CHP**
	⇒	r) Minimum 15 minutes torque (As applicable)	MECH	- do -	- do -	- do -	- do -	**CHP**
2.	Type Tests	a) Measurement of noise.	MECH	One of design for each type	Specification, IS 325, IS 12075, BS 4999 & IS 13947 (Part 1)	Test Report	Lab	**CHP** – for Verification of test reports
		b) Measuement of vibration.	MECH	- do -	- do -	- do -	- do -	**CHP** – for Verification of test reports
	⇒	c) Rated torque test	MECH	- do -	- do -	- do -	- do -	**CHP** – for Verification of test reports
	⇒	d) Stall torque test.	MECH	- do -	- do -	- do -	- do -	**CHP** – for Verification of

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	TYPE OF CHECK	QUANTUM OF CHECK	REF.DOC. & ACCEPTANCE STANDARD	FORMAT OF RECORD	AGENCY	REMARKS
								test reports
		e) Temperature rise test.	ELEC	One of design for each type	Specification, IS 325, IS 12075, BS 4999 & IS 13947 (Part 1)	Test Report	Lab	**CHP** – for Verification of test reports
	⇒	f) Enclosure protection test for total actuator	ENVI	- do -	- do -	- do -	- do -	**CHP** – for Verification of test reports
		g) Gear box sturdiness test.	MECH	- do -	- do -	- do -	- do -	**CHP** – for Verification of test reports

B. NOTES

1. ELEC : ELECTRICAL; MECH : MECHANICAL;
   ENVI : ENVIRONMENTAL; MEAS : MEASUREMENT;
   VISU : VISUAL ; T.C. : TEST CERTIFICATE;
   PHYS : PHYSICAL
   MQCD : MANUFACTURER'S QUALITY CONTROL DEPARTMENT;
   ⇒ : CRITICAL TO QUALITY POINTS;
   CHP : CUSTOMER HOLD POINT - INSPECTION BY BHEL.

2. All the testing facilities shall be arranged by the vendor at their works.

3. All measuring and test instruments must be periodically calibrated at recognised test laboratories and test certificates shall be made available during inspection for verification.

4. Test certificates for routine & type tests are to be furnished by the vendor. Type test certificate shall not be earlier than 5 years from the date of Purchase enquiry. If any changes are made in the design, material and process, the type tests shall be repeated, irrespective of the validity of existing type test certificate.

5. Packing shall be as per the " PACKING PROCEDURE " indicated in the Specification.

6. Packing shall be as per the ' PACKING PROCEDURE ' indicated in the Specification. Any loose supply items for the purpose of ' Safe transit ' shall be clearly indicated in the packing slip.

7. Vendor to give tentative inspection programme in advance & confirm exact date two weeks in advance for arranging BHEL's inspection

C. REFERENCE STANDARDS: (For The Indicated Standards Refer The Latest Version)

IS 325	:	Specification for three phase Induction motor.
IS 9334	:	Specification for Electric motor operated actuator.
IS 12075	:	Vibration Measurement on Rotating Electrical machine.
IS4905	:	Methods for Random Sampling
IS 13947 (Part 1)	:	General rules for low voltage switchgear (Degrees of Enclosure protection offered by enclosure.)
BS 4999	:	General requirement for rotating Electrical machinery.

D. SAMPLING PLAN FOR INSPECTION (CHP)

a) As Per IS 4905 or 10% of offered quantity as per the discretion of the inspector.

b) If non – conformance is observed on one number in any character, then inspection shall be carried out on all 100%.

BHARAT HEAVY ELECTRICALS LIMITED / TIRUCHIRAPPALLI

CONTROLS AND INSTRUMENTATION/QAC/FB

CONTRACT QUALITY PLAN

FOR

FLAME SCANNER CABLES

(ELASTOMERIC/THERMOPLASTIC/EQUIVALENT CABLES)
(BOUGTOUT ITEMS)

KOSTI SUDAN 4 X 125 MW

NATIONAL ELECTRICITY CORPORATION, SUDAN

REV	DATE	PREPARED	REVIEWED	APPROVED	REVISION HISTORY
00	09/05/06	Sd/-	Sd.-	Sd.-	Initial Release
01	20/11/06	Sd/-	Sd.-	Sd.-	Revised as per IO/BHEL email dt. 16/11/06.
02	05/02/07	RM.VAIRAVAN	N.SRIDHAR	S.SOMASUNDARAM	General revisions

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	TYPE OF HECK	QUANTUM OF CHECK	REF.DOC. & ACCEPTANCE STANDARD	FORMAT OF RECORD	AGENCY			REMARKS
							M	B	C	
NOTE : **1. This is a general QP for Elastomeric/Thermoplastic/Equivalent cables of all combination.** **2. Applicability of tests will be based on Purchase specification requirements.**										
A.	**RAW MATERIALS & BOUGHT OUT ITEMS INSPECTION**									
1.	Copper Rod / Wires	a) Diameter	MEAS	OSPL of 1000 mtr.	IS 613, IS 8130 & spec.	T.R / LGB	P	V	-	Material TC from Supplier shall be produced at the time of inspection.
		b) Tensile strength	MECH	- do -	- do -	- do -	P	V	-	
		c) % Elongation	MECH	- do -	- do -	- do -	P	V	-	
		d) Resistivity	ELEC	- do -	- do -	- do -	P	V	-	
2.	Elastomeric compound (for insulation sheath) # Refer Note-11	a) Tensile strength and Elongation (Before and after ageing).	MECH	- do -	IS 10810 , IS 6380, Appd data sheet	- do -	P	V	-	
		b) Volume resistivity at 27 °C	ELEC	- do -	- do -	- do -	P	V	-	
		C) Hot Deformation	THER	- do -	- do -	- do -	P	V	-	
3.	Galvanised wire / strip (If applicable)	a) Dimension	MEAS	OSPL of 1000 mtr.	IS 3975 & speci.	T.R / LGB	P	V	-	
		b) Tensile strength & % Elongation	MECH	- do -	- do -	- do -	P	V	-	
		c) Mass of Zinc Coating	CHEM	- do -	- do -	- do -	P	V	-	
		d) Uniformity of Zinc Coating	CHEM	- do -	- do -	- do -	P	V	-	
4.	Melinex type	a) Dimension	MEAS	OSPL of 1000 mtr.	Appd Data sheet	- do -	P	V	-	
		b) Tensile strength	MECH	- do -	Mfr STD	- do -	P	V	-	
		c) Heat stability	THER	- do -	- do -	- do -	P	V	-	
		d) Tear strength	PHYS	- do -	- do -	- do -	P	V	-	
5.	Aluminium Backed	a) Dimension	MECH	OSPL of 1000	Mfr STD	T.R /	P	V	-	

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	TYPE OF HECK	QUANTUM OF CHECK	REF.DOC. & ACCEPTANCE STANDARD	FORMAT OF RECORD	AGENCY			REMARKS
							M	B	C	
	Mylar Tape			mtr.		LGB				
		b) Adhesion of Aluminium tape with Mylar tape.	CHEM	OSPL of 1000 mtr.	Mfr STD	- do -	P	V	-	
		c) Conductivity of Aluminium tape	ELEC	- do -	Mfr STD	TR/LGB	P	V	-	
B.	**IN PROCESS INSPECTION**									
1.	Copper Wire (For Conductor & Drain Wire)	a) Diameter	MEAS	- do -	IS 8130 , IS 10810 , Spec & Apprd data sheet.	LGB	P	V	-	
		b) Surface finish	VISU	- do -	- do -	- do -	P	V	-	
		c) % Elongation	MECH	- do -	- do -	- do -	P	V	-	
		d) Per Sulphate Test (Applicable For tinned conductor)	CHEM	- do -	- do -	- do -	P	V	-	
		e) Resistance	ELEC	- do -	- do -	- do -	P	V	-	
2.	Conductor formation (For conductor & drain wire)	a) Number of wires	VISU	At start on sample from each setting	IS 8130 , IS 10810 & Specification Approved data sheet	LGB	P	V	-	
		b) Diameter of wire	MEAS	- do -	- do -	- do -	P	V	-	
		c) Stranding direction	VISU	- do -	- do -	- do -	P	V	-	
		d) Stranding pitch	MEAS	- do -	- do -	- do -	P	V	-	
		e) Conductor surface	VISU	100%	- do -	- do -	P	V	-	
		f) Conductor resistance	ELEC	- do -	- do -	- do -	P	V	-	
3.	Insulated Core # Refer Note-11	a) Thickness and colour of insulation	MEAS	At start on sample from each setting	IS10810 ,IS 9968 (Part 1) , IS 6380 & Appd data sheet	- do -	P	V	-	
		b) Dia over insulation	MEAS	- do -	- do -	- do -	P	V	-	
		c) Concentricity	MEAS	- do -	Mfr STD	- do -	P	V	-	
		d) Tensile strength	MECH	- do -	Appd data sheet	- do -	P	V	-	

P – PERFORM; V – VERIFICATION BY BHEL; W – WITNESS BY BHEL; M – MANUFACTURER; B – BHEL/TPI; C – CUSTOMER (NEC, SUDAN)

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	TYPE OF HECK	QUANTUM OF CHECK	REF.DOC. & ACCEPTANCE STANDARD	FORMAT OF RECORD	AGENCY			REMARKS
							M	B	C	
		e) % Elongation	MECH	- do -	Appd data sheet	- do -	P	V	-	
		f) Insulation Resistance	ELEC	100%	Appd data sheet	- do -	P	V	-	
		g) Spark test	ELEC	100 %	3 KV RMS	LGB	P	V	-	
		h) HV test	ELEC	One Sample from each setting	2 KV rms for 1 minute in water.	- do -	P	V	-	
4.	Pair Twisting and cable formation.	a) Colour sequence of cores	VISU	Sample from each setting	Spec , Appd data sheet	- do -	P	V	-	
		b) Direction of laying up	VISU	- do -	Mfr STD	- do -	P	V	-	
		c) Lay length	MEAS	- do -	Appd data sheet	- do -	P	V	-	
		d) Diameter over laid up core	MEAS	- do -	- do -	- do -	P	V	-	
		e) Binder type	VISU	- do -	- do -	- do -	P	V	-	
5.	Individual pair Screening & over all screening with Drain Wire.	a) Number of layers	VISU	- do -	Spec Appd data sheet	- do -	P	V	-	
		b) Over lap	VISU	- do -	- do -	- do -	P	V	-	
		c) Tightness & coverage	VISU MEAS	- do -	- do -	- do -	P	V	-	
		d) Surface finish	MEAS	- do -	- do -	- do -	P	V		
		e) Continuity	ELEC	- do -	- do -	- do -	P	V	-	
6.	Inner Sheath (If applicable) # Refer Note-11	a) Diameter over inner sheath	MEAS	OSPL	IS 9968 (Part 1), IS 6380 Spec and Appd data sheet	LGB	P	V	-	
		b) Thickness	MEAS	OSPL	- do -	- do -	P	V	-	
		c) Surface finish	VISU	- do -	- do -	- do -	P	V	-	
7.	Armouring (If applicable)	a) Size of wire/strip	MEAS	Starting & End of Sample	Approved data sheet	- do -	P	V	-	
		b) Diameter over armour	MEAS	- do -	- do -	- do -	P	V	-	
		c) Direction of Lay &	VISU	- do -	- do -	- do -	P	V	-	

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	TYPE OF HECK	QUANTUM OF CHECK	REF.DOC. & ACCEPTANCE STANDARD	FORMAT OF RECORD	AGENCY			REMARKS
							M	B	C	
		coverage								
		d) Surface finish	VISU	Starting & End of Sample	Mfr STD	- do -	P	V	-	
8.	Outer sheath # Refer Note-11	a) Diameter over sheath	MEAS	One Random sample of 1 m	Appd data sheet	LGB	P	V	-	
		b) Thickness	MEAS	- do -	- do -	- do -	P	V	-	
		c) Eccentricity	VISU	- do -	Mfr STD	- do -	P	V	-	
		d) Surface finish	VISU	Over continuous length	- do -	- do -	P	V	-	
		e) Tensile Strength & % Elongation	MEAS	One Random Sample of 1 M	IS 9968	- do -	P	V	-	
		f) Marking & Embossing	VISU	- do -	- do -	- do -	P	V	-	
9.	Drums	a) Anti Termite Treatment	VISU	100%	Manufacturer ‘s Std.,	- do -	P	-	-	
		b) Anti Fungus Treatment	CHEM	- do -	- do -	- do -	P	-	-	
		c) Nails clinched inside	VISU	- do -	- do -	- do -	P	-	-	
		d) Clearance from logging minimum 10 mm	VISU	- do -	- do -	- do -	P	-	-	
		e) Painting & Packing	VISU	- do -	- do -	- do -	P	-	-	
C.	**FINAL INSPECTION**									
1.	Routine tests	a) Conductor resistance	ELEC	100%	IS 8130, IS 10810 Appd data sheet.	LGB	P	W	-	
		b) Insulation resistance	ELEC	- do -	- do -	- do -	P	W	-	
		d) HV test	ELEC	- do -	- do -	- do -	P	W	-	
		e) Drain wire continuity	ELEC	- do -	- do -	- do -	P	W	-	
2.	Acceptance Tests	a) Conductor	ELEC	10% of	Approved data sheet	T.R	P	W	-	

P – PERFORM; V – VERIFICATION BY BHEL; W – WITNESS BY BHEL; M – MANUFACTURER; B – BHEL/TPI; C – CUSTOMER (NEC, SUDAN)

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	TYPE OF HECK	QUANTUM OF CHECK	REF.DOC. & ACCEPTANCE STANDARD	FORMAT OF RECORD	AGENCY			REMARKS
							M	B	C	
		resistance		quantity subject to a minimum of 1 drum						
	⇒	b) Constructional , Dimensional check & Colour coding	VISU & MEAS	- do -	- do -	- do -	P	W	-	
		d) Drain wire continuity	ELEC	- do -	- do -	- do -	P	W	-	
		e) Insulation resistance test	ELEC	- do -	- do -	- do -	P	W	-	
	⇒	f) Electrical test parameter (Mutual Capacitance, characteristic impedance , attenuation and cross talk)	ELEC	10% of quantity subject to a minimum of 1 drum	Approved data sheet	T.R	P	W	-	
		g) Per sulphate test(Applicable for tinned conductor)	ELEC	- do -	IS 8130	- do -	P	W	-	
		h) Verification of coil length, finish and cable marking	MEAS	- do -	Approved data sheet	- do -	P	W	-	
		i) Flammability Characteristic (Finished cable)	PHYS	-do-						
		i) Swedish chimney test.	ENVI	OSPL	SS 424 14 75,Cl.F3	- do -	P	W	-	
		ii) Vertical Flame Test.	ENVI	- do -	IEEE - 383	- do -	P	W	-	
		j) FRLS test for insulation and sheath	PHYS	-do-	-do-					
		i) Oxygen index	ENVI	- do -	ASTM-D 2863 & Appd	- do -	P	W	-	

P – PERFORM; V – VERIFICATION BY BHEL; W – WITNESS BY BHEL; M – MANUFACTURER; B – BHEL/TPI; C – CUSTOMER (NEC, SUDAN)

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	TYPE OF HECK	QUANTUM OF CHECK	REF.DOC. & ACCEPTANCE STANDARD	FORMAT OF RECORD	AGENCY			REMARKS
							M	B	C	
					data sheet					
		ii) Temperature index	ENVI	- do -	ASTM D 2863	- do -	P	W	-	
		iii) Smoke density rating	ENVI	- do -	ASTM-D 2843 & Appd data sheet	T.R	P	W	-	
		iv) Acid gas generation	ENVI	- do -	IEC 754 (1) & Appd data sheet .	- do -	P	W	-	
		l) Volume resistivity at 27 deg. C	ELEC	- do -	Approved data sheet	- do -	P	W	-	
		m)Tensile strength % elongation of insulation and sheath before and after ageing	ENVI	- do -	- do -	- do -	P	W	-	
3.	Type Tests	a) Per Sulphate test (For tinned copper)	CHEM	OSPL	IS 8130, IS 10810 & Approved data sheet	- do -	P	V	-	
		b) Annealing test (For Copper)	MECH	- do -	- do -	- do -	P	V	-	
		c) Conductor resistance	ELEC	- do -	- do -	T.R	P	V	-	
		d) Test For Thickness of insulation and sheath and overall diameter.(Where Specified)	MEAS	- do -	- do -	- do -	P	V	-	
		e) Physical tests for insulation and sheath (As applicable)	PHYS	-do-	-do-	-do-	P	V	-	
		i) Tensile strength and elongation at break	MECH	- do -	- do -	- do -	P	V	-	
		ii) Ageing in air	ENVI	- do -	- do -	- do -	P	V	-	

P – PERFORM; V – VERIFICATION BY BHEL; W – WITNESS BY BHEL; M – MANUFACTURER; B – BHEL/TPI; C – CUSTOMER (NEC, SUDAN)

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	TYPE OF HECK	QUANTUM OF CHECK	REF.DOC. & ACCEPTANCE STANDARD	FORMAT OF RECORD	AGENCY			REMARKS
							M	B	C	
		oven								
		iii) Hot deformation test	ENVI	OSPL	IS 8130, IS 10810 & Approved data sheet	- do -	P	V	-	
		f) Insulation resistance	ELEC	- do -	- do -	- do -				
		g) High voltage test	ELEC	- do -	IS 10810 & Approved data sheet	T.R	P	V	-	
		h) Flammability test (Applicable to finished cable)								
		i) Swedish chimney test.	ENVI	OSPL	SS 424 14 75,Cl.F3	- do -	P	V	-	
		ii) Vertical Flame Test.	ENVI	- do -	IEEE- 383	- do -	P	V	-	

D. NOTES :

1.LEGEND:

PHYS : PHYSICAL; CHEM : CHEMICAL;
ELEC : ELECTRICAL; VISU : VISUAL;
MECH : MECHANICAL; MEAS : MEASUREMENT
OSPL : ONE SAMPLE PER LOT; TC : TEST CERTIFICATES;
⇒ :CRITICAL TO QUALITY POINTS; TR : TEST REPORT
FRLS : FIRE RETARDANT LOW SMOKE;

2. All testing facilities shall be arranged by the vendor at their works.
3. Through Log Books/any other documents available at the vendor's works, it shall be possible to correlate the finished product with raw material & in process stage checks / inspection carried out.
4. All measuring & testing instruments shall be periodically calibrated from recognized test houses & certificates made available during inspection for verification.
5. Test certificates for routine & type tests conducted on offered cables are to be furnished by the vendor.
6. Vendor to give tentative inspection program in advance & confirm exact date two weeks in advance for arranging BHEL's inspection.
7. Packing shall be as per the " PACKING PROCEDURE " indicated in the Specification.
8. Cable ends shall be sealed with heat shrinkable type PVC caps to avoid ingress of moisture.
9. Process records for all stages shall be certified by vendors QC and are subject to review during inspection. Traceability shall be possible during inspection for raw material of conductor, insulation , sheath , wire and compound.
10. Elastomeric/Thermoplastic/Equivalent compound and other raw materials shall be procurred from reputed manufacturer only. If special insulation and sheath compounds (eg. Low Smoke Low Halogen type) are being used, manufacturer's guaranteed technical particulars and T.C shall be available for review.
11. Wherever Thermoplastic/Equivalent material is offered for Insulation and Sheath , the same shall be indicated under "Remarks" column of QP with applicable standard. QP will be reviewed for the suitability as per the options provided in the Engg. Specification.
12. If non - conformance is observed on sample drum in any character, then inspection shall be carried out on all 100%.
13. **Inspection / verification will be done by BHEL / Authorised Inspection Agency.**

F. REFERENCE STANDARDS :

(For The Indicated Standards Refer The Latest Version)

IS 9968 / (Part 1)	:	Specification for Elastomeric insulated cables (Heavy Duty)for working Voltages upto and including 1100V.
IS 3975	:	Mild Steel wires , strips and tapes for armouring cables.
IS 6380	:	Specification for Elastomeric insulation and sheath electric cables.
IS 8130	:	Conductors for insulator electric cables & Flexible cables.
IS 10810	:	Method of test for cables.
ASTM-D 2843	:	Standard test method for density of smoke from burning and discomposition of plastics.
ASTM-D 2863	:	Standard test method for Oxygen / temperature index test.
IEC 754 / (Part 1)	:	Test on Gases evolved during combustion of Electric cables (Part1) : Determination of that amount of Halogen acid gas evolved during the combustion of polymeric materials taken from cables.
IEEE- 383	:	Standard for type test class IE Electric cables , Filler splices & connection for Nuclear power generating stations.
SS 424 14 75	:	Svensk Standard - Flammability Testing.
IS 613	:	Copper Rods and Bars for Electrical Purposes .
IEC 332 / (Part 1)	:	Test on Electric cables under fire conditions.

BHARAT HEAVY ELECTRICALS LIMITED

TIRUCHIRAPPALLI

QUALITY ASSURANCE

CONTROLS AND INSTRUMENTATION

STANDARD QUALITY PLAN

FOR

PRESSURE & DP SWITCHES

REV	DATE	PREPARED	REVIEWED	APPROVED	REVISION HISTORY
00	03.11.92	--- Sd ---	--- Sd ---	--- Sd ---	Initial release.
01	16.06.97	--- Sd ---	--- Sd ---	--- Sd ---	Format revised
02	21.03.02	A.J.OMPRAKASH	R.VARADARAJAN	G.MATHIYALAGAN	Department name changed, CTQ requirements added & General revision.

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	TYPE OF CHECK	QUANTUM OF CHECK	REF. DOC & ACCEPTANCE STD	FORM OF RECORD	AGENCY	REMARKS
		FINISHED PRODUCT INSPECTION						
A)	ROUTINE TEST	1) PHYSICAL & DIMENSIONAL CHECK	PHYS	100 %	SPEC., BS 6134 & IS 3624	TEST REPORT	MQCD	**C H P**
		| 2) PROCESS AND ELECTRICAL CONNECTON.	MEAS.					
		| 3) CALIBRATION (ACCURACY) TEST INCLUDING HYSTERISIS AT RAISING / FALLING PARAMETERS BEFORE AND AFTER OVER PRESS. (MIN. 4 POINTS OVER RANGE)	MEAS					
		| 4) REPEATABILITY TEST	MEAS					
		| 5) CHECK FOR SWITCHING DIFFERENTIAL (DEAD BAND) .	ELEC					
		6) HIGH VOLTAGE TEST.	ELEC					
		7) INSULATION RESISTANCE TEST BEFORE & AFTER HIGH VOLTAGE TEST	ELEC					
		8) OVER PRESSURE TEST	MEAS					
		| 9) CONTACT TYPE, RATING AND ACTION	PHYS					
		| 10) SET POINT	PHYS					
		| 11) PULSATION DAMPER / SNUBBER	PHYS					
		| 12) PROOF PRESSURE TEST- FOR DP SWITCH	MEAS					
		| 13) 3/5 VALVE MANIFOLD - FOR DP SWITCH	PHYS					
B)	TYPE TEST	| ENCLOSURE PROTECTION TEST	ENVI	ONE OF DESIGN	SPEC & IS 13947Pt 1	TEST REPORT	TEST LAB	VERIFICATION OF TYPE TEST CERTIFICATES – **C H P**

\| **: CRITICAL TO QUALITY (CTQ) POINTS**

C. NOTES :

i) MQCD : MANUFACTURER'S QUALITY CONTROL DEPARTMENT;
PHYS : PHYSICAL ;
MECH : MECHANICAL ;
MEAS : MEASUREMENT;
ELEC : ELECTRICAL;
SPEC : SPECIFICATION;
ENVI : EUVIRONMENTAL;
| : CRITICAL TO QUALITY (CTQ) POINTS;
STD : STANDARD;
DOC : DOCUMENT;
DP : DIFFERENTIAL PRESSURE;
CHP : CUSTOMER HOLD POINT - INSPECTION BY BHEL.

ii) All testing facilities shall be arranged by the vendor at their works.

iii) Measuring & testing instruments shall be periodically calibrated from recoginsed test house and certificates made available during inspection.

iv) Test certificate for routine tests and type tests to be furnished by the vendor.

v) Matl. subject to inspection and vendor to give inspection programme 3 weeks in advance for arranging BHEL inspection.

vi) Type test to be carried out at recognised test house and type test certificate shall not earlier than 5 years from the date of Purchase enquiry. If there is any change in design material or process then the type test shall be repeated irrespective of the validity of the existing type test certificate.

vii) Packing shall be as per the ' PACKING PROCEDURE ' indicated in the Spection.

D. REFERENCE STANDARDS : (FOR THE INDICATED STANDARDS REFER THE LATEST VERSION)

BS : 6134 : Specn. for pressure , vaccum switches.

IS : 13947Pt 1 : General rules for low voltage switch gear (Degree of protection provided by enclosures.)

IS : 3624 : Specification for pressure vaccum gauges

E.SAMPLING PLAN FOR INSPECTION:

a) 10% of offered quantity subject to a maximum of five numbers.

b) If non-conformance is observed on one number in any character, then inspection shall be carried out on all 100%.