

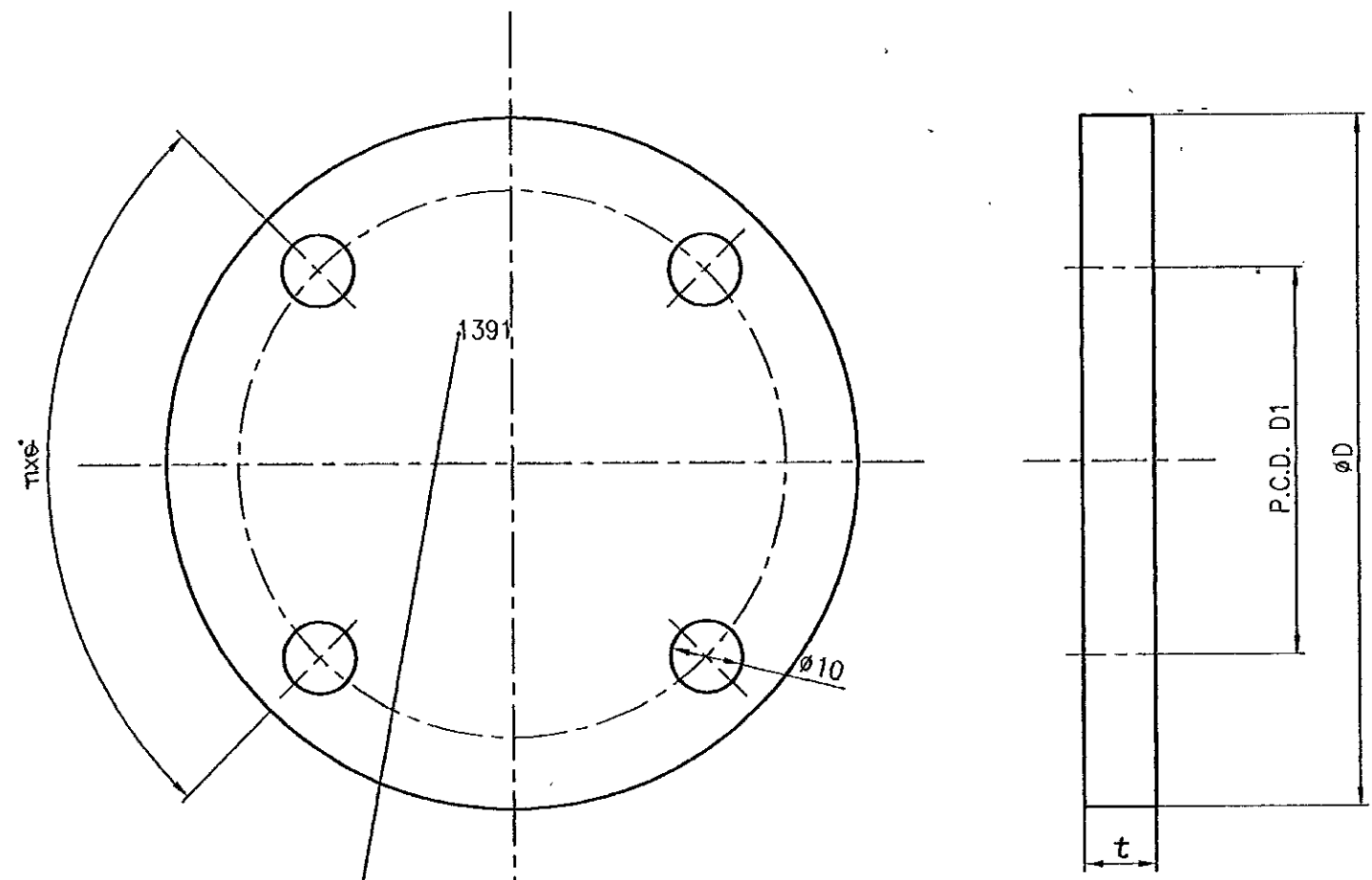
407910-0000-01767/04

DRAWING NO.

ALL DIMENSIONS ARE IN MILLIMETRES. FOR TOLERANCES OF UNTOLERANCED DIMENSIONS DURING MANUFACTURE REFER RELEVANT QCP / QP

A	SL.No	NP	NB	DRG.No.	DIMENSIONS					MATL. CODE.
					φ D	D1 PCD	t	THK	NET WT (kg)	
A	01	NP:10&16	100	2-V-1391-01767/1	215	180	3	4x90°	0.117	22071005
	02		125	2-V-0103-01767/1	245	210	3	4x90°	0.153	22071006
	03		150	2-V-1373-01767/1	SAME AS IN SL.No:-56					
	04		200	2-V-1394-01767/1	335	295	3	6x60°	0.286	22071008
B	05	NP 16	250	2-V-1395-01767/1	405	355	3	6x60°	0.420	22071009
	06		300	2-V-1317-01767/1	460	410	3	6x60°	0.542	22071010
	07		400	2-V-1318-01767/1	580	525	6	8x45°	1.350	22071011
	08		600	2-V-1209-01767/1	840	770	6	8x45°	2.850	22071012
C	09	NP:10,16&40	15	2-V-2301-01767/1	95	65	3	4x90°	0.021	22071013
	10		20	2-V-2341-01767/1	105	75	3	4x90°	0.027	22071014
	11		25	2-V-2302-01767/1	115	85	3	4x90°	0.032	22071015
	12		32	2-V-2242-01767/1	135	100	3	4x90°	0.044	22071016
D	13	NP:10,16&40	40	2-V-0203-01767/1	145	110	3	4x90°	0.051	22071017
	14		50	2-V-0204-01767/1	160	125	3	4x90°	0.063	22071003
	15		65	2-V-0205-01767/1	180	145	3	4x90°	0.080	22071018
	16		80	2-V-1371-01767/1	SAME AS IN SL.No. 54					
E	17	NP 40	100	2-V-1372-01767/1	SAME AS IN SL.No:- 55					
	18		125	2-V-2226-01767/1	SAME AS IN SL.No:- 41					
	19		150	2-V-2411-01767/1	300	250	3	4x90°	0.226	22071021
	20		200	2-V-2412-01767/1	375	320	3	6x60°	0.356	22071022
F	21	NP 64	250	2-V-0181-01767/1	445	385	3	6x60°	0.503	22071023
	22		300	2-V-0183-01767/1	510	450	3	8x45°	1.031	22071024
	23		400	2-V-1217-01767/2	635	585	6	8x45°	1.709	22071025
	24		500	2-V-1218-01767/1	755	670	6	8x45°	2.279	22071026
G	25	NP 64	50	2-V-0187-01767/1	175	135	3	4x90°	0.075	22071027
	26		65	2-V-0188-01767/1	200	160	3	4x90°	0.100	22071064
	27		80	2-V-1378-01767/1	SAME AS IN SL.No:-65					
	28		100	2-V-0103-01767/1	SAME AS IN SL.No:-2					
H	29	NP 100	150	2-V-0191-01767/1	340	280	3	4x90°	0.290	22071030
	30		200	2-V-1395-01767/1	SAME AS IN SL.No:-5					
	31		250	2-V-0182-01767/1	470	400	3	6x60°	0.560	22071032
	32		300	2-V-0184-01767/1	530	460	3	8x45°	1.110	22071033
I	33	NP:64&100	15	2-V-2341-01767/1	SAME AS IN SL.No:-10					
	34		20	2-V-2214-01767/1	SAME AS IN SL.No:-43					
	35		25	2-V-2242-01767/1	SAME AS IN SL.No:-12					
	36		32	2-V-1370-01767/1	SAME AS IN SL.No:-53					
J	37	NP 250	40	2-V-1377-01767/1	SAME AS IN SL.No:-64					
	38		50	2-V-1371-01767/1	SAME AS IN SL.No:-54					
	39		65	2-V-1391-01767/1	SAME AS IN SL.No:-1					
	40		80	2-V-1372-01767/1	SAME AS IN SL.No:-55					
K	41	NP 250	100	2-V-2226-01767/1	265	210	3	4x90°	0.173	22071038
	42		150	2-V-0354-01767/1	350	290	3	6x60°	0.207	22071068
	43		15	2-V-2214-01767/1	125	90	3	4x90°	0.037	22071069
	44		25	2-V-0203-01767/1	SAME AS IN SL.No:-13					
L	45	NP 250	40	2-V-0205-01767/1	SAME AS IN SL.No:-15					
	46		65	2-V-2225-01767/1	SAME AS IN SL.No:-55					
	47		250	2-V-0347-01767/1	585	490	3	8x45°	1.328	22071039

A	SL.No	NP	NB	DRG.No.	DIMENSIONS					MATL. CODE.
					φ D	D1 PCD	t	THK	NET WT (kg)	
A	48	NP 2.5	800	2-V-0112-01767/1	975	920	6	12x30°	3.864	22071001
	49		1200	2-V-0113-01767/1	1375	1320	6	16x22½°	7.800	22071002
	50		300	2-V-0109-01767/1	435	395	3	6x60°	0.486	22071072
	51		200	2-V-0126-01767/1	360	310	3	6x60°	0.329	22071073
B	52	NP 25	300	2-V-0127-01767/1	485	430	3	8x45°	0.602	22071074
	53		2"	2-V-1370-01767/1	152	121	3	4x90°	0.050	22071040
	54		3"	2-V-1371-01767/1	190	152	3	4x90°	0.082	22071041
	55		4"	2-V-1372-01767/1	229	190	3	4x90°	0.120	22071042
C	56	150 LBS.	6"	2-V-1373-01767/1	279	241	3	4x90°	0.180	22071043
	57		8"	2-V-0191-01767/1	SAME AS IN SL.No:-29					
	58		10"	2-V-1395-01767/1	SAME AS IN SL.No:-5					
	59		12"	2-V-1376-01767/1	483	432	3	6x60°	0.544	22071046
D	60	300 LBS.	14"	2-V-1386-01767/1	533	476	6	6x60°	0.654	22071047
	61		16"	2-V-1387-01767/1	597	540	6	8x45°	0.824	22071048
	62		20"	2-V-1512-01767/1	695	635	6	10x36°	1.200	22071049
	63		24"	2-V-1388-01767/1	813	749	6	10x36°	1.534	22071050
E	64	NP: 10	2"	2-V-1377-01767/1	165	127	3	4x90°	0.061	22071051
	65		3"	2-V-1378-01767/1	209	168	3	4x90°	0.098	22071052
	66		4"	2-V-1379-01767/1	254	200	3	4x90°	0.147	22071053
	67		6"	2-V-1380-01767/1	317	270	3	6x60°	0.232	22071054
F	68	150 C	8"	2-V-1381-01767/1	381	330	3	6x60°	0.336	22071055
	69		10"	2-V-1382-01767/1	444	387	3	8x45°	0.457	22071056
	70		12"	2-V-1383-01767/1	521	451	3	8x45°	0.630	22071057
	71		14"	2-V-1384-01767/1	584	514	6	10x36°	0.784	22071058
G	72	NP: 10	1½"	2-V-1370-01767/1	SAME AS IN SL.No:-53					
	73		300	2-V-0522-01767/1	440	400	3	6x60°	0.52	22071060
	74		400	2-V-0537-01767/1	565	515	6	8x45°	1.31	22071061
	75		500	2-V-0538-01767/1	670	620	6	10x36°	1.5	22071062
H	76	150 C	600	2-V-0539-01767/1	780	725	6	10x36°	1.7	22071063
	77		800	2-V-0503-01767/1	1015	950	6	12x30°	2.5	22071075
	78		26"	2-V-N834-01767/1	785	745	6	9x40°	1.7	22071076
	79		28"	2-V-N847-01767/1	835	795	6	10x36°	1.9	22071077
I	80	NP: 10	30"	2-V-N848-01767/1	885	845	6	11x32.7°	2.1	22071078
	81		32"	2-V-N827-01767/1	940	900	6	12x30°	2.3	22071079
	82		36"	2-V-N988-01767/1	1170	1085	6	8x45°	3.5	22071080
	83		36"	2-V-N846-01767	1055	1010	6	11x32.7°	2.7	22071081



CAUTION: The information on this document is the property of BHARAT HEAVY ELECTRICALS LTD. It must not be used directly or indirectly in any way detrimental to the interest of the company.

REV	DATE	ALTERED	R.L.
04	19.7.2K	CHD & APPD	M.R.K.
SL.NO.83 INCLUDED. DIMS.CORRECTED FOR SL.NO.78 TO 82. DCN NO.HM 0459			

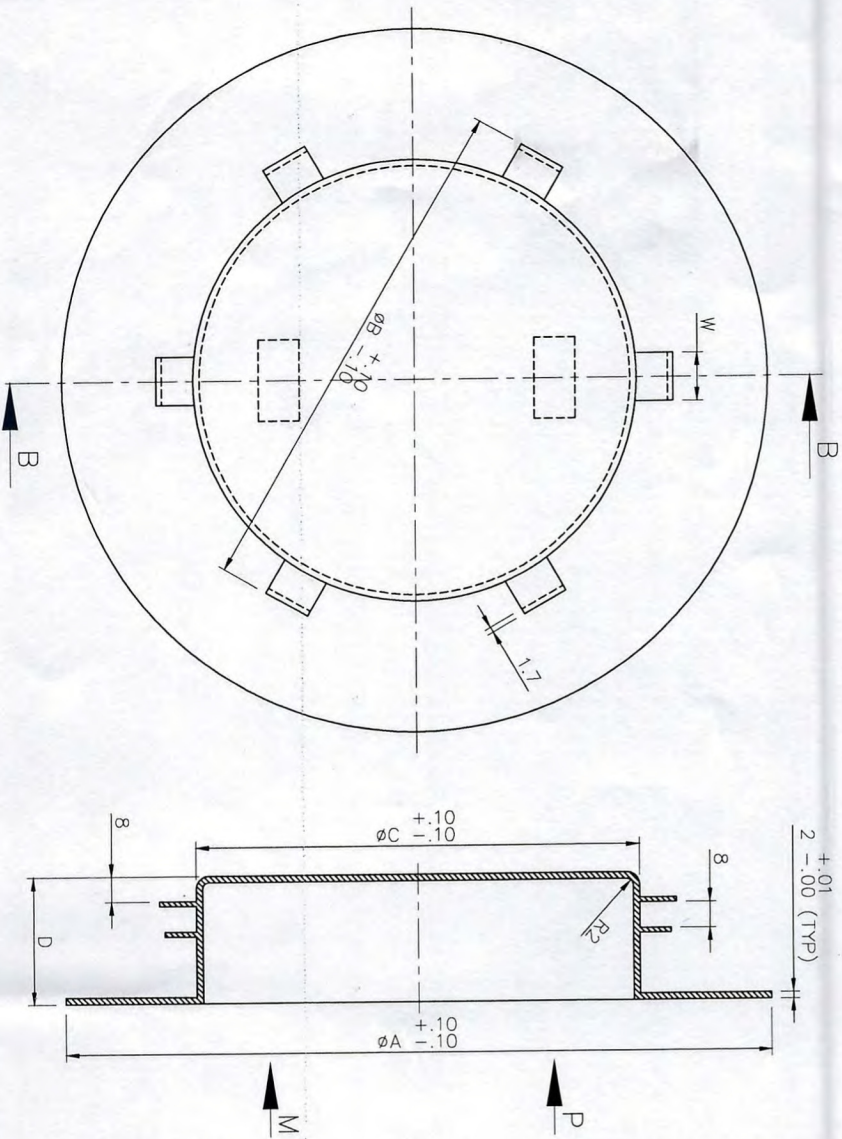
MATL SPECN. STANDARD HARD BOARD IS.1658									
No OFF	DESCRIPTION	MATL CODE	MATL SPECN	HEAT TREATMENT	SCRAP SORT	NET WT (kg)	GROSS WT (kg)	DRAWING No	ITEM No
TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT									
RETRACED WITH REV.4 ON 19.7.2000									
BHARAT HEAVY ELECTRICALS LTD., UNIT: HIGH PRESSURE BOILER PLANT. TIRUCHIRAPALLI-620014.									
DRN	NAME	SIGN	DATE	NO.OF VAR.					
CHD	R.L.NARAYANAN	[Signature]	19/7/2000						
APPD	M.RAJAKUMAR	[Signature]	19/7/2000						
DEPT	V L	SCALE	WEIGHT (KG).	REFERENCE INFORMATION			NO. OF ITEMS		
CODE	320	N T S		CAD REF:- C201767					
TITLE				CARD CODE	DRAWING NO.				REV
END COVER				U 01	2-V-0000-01767				04

1			2			3			4			5			6			7			8		
2-V-0000-15483			ALL DIMENSIONS ARE IN MILLIMETRES. FOR TOLERANCES OF UNTOLERANCED DIMENSIONS DURING MANUFACTURE REFER RELEVANT QCP / QP																				
SL.No.	DRAWING No.	MATL. CODE	øD ⁺² ₀	L ⁺⁴ ₀	NET WT (Kg)	APPLICABLE VALVE SIZES	SL.No.	DRAWING No.	MATL. CODE	øD ⁺² ₀	L ⁺⁴ ₀	NET WT (Kg)	APPLICABLE VALVE SIZES	<									

PLASTIC END COVER

REV: 02

1. MATERIAL CODE: REFER TABLE
2. MATERIAL: LOW DENSITY POLYETHYLENE (LDPE)
3. COLOR: DARK BLUE
4. MARK/CAST SIZE IN DIRECTION-P. REFER COLUMN 'MARK'.
5. MARK/CAST VENDOR 'MAKE' IN DIRECTION-M.
6. ALL DIMENSIONS ARE IN MM.



SL. NO.	MATERIAL CODE	DIMENSIONS					MARK	REMARKS
		ϕA	ϕB	ϕC	D	W		
1	G96120880000	92	57	35	25	15	NB-50	2 INCH
2	G96120890000	127	85	58	25	15	NB-80	3 INCH
3	G96120870000	150	107	78	35	25	NB-100	4 INCH
4	G96120860000	215	158	136	40	25	NB-150	6 INCH
5	G96120910000	268	210	180	40	25	NB-200	8 INCH
6	G96120920000	320	258	220	40	25	NB-250	10 INCH
7	G96120930000	380	309	268	40	25	NB-300	12 INCH

SECTION-BB

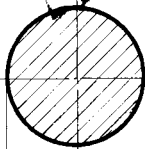
TP-DG-4-V-0000-04046
CORPORATE DRG ID

DATE: 23-9-75
CHECKED: *D.V. Kumar*

ZONE: 1. DRG. REDRAWN.
2. IN SL. NO. 3. REQUIREMENT FOR 2½" & 4" - 5000 PSI ADDED

REV. 2
DATE: 11.6.75
ALTRD: S.S. Sankar
APPD: *Babu*

0.4/
✓ SURFACE FINISH IS ADDED.



φd ± 0.1

SV - STOP VALVE

RV - REGULATING VALVE

FBV - FULL BORE VALVE

SL. NO.	DRAWING NOS.	MATL. CODE	φd ± 0.1	Wt. PER 1000 NOS (KG)	NO. OFF/VALVE	APPLICABLE VALVES
1	4-V-2253-04046	55017397	4	0.26	1	2 WAY & 3 WAY PR. GAUGE VALVE
					10	15/100/III SV & RV
					12	25/100/III SV & RV
					16	40/100/III SV & RV
2	4-V-2242-04046	55017555	5.5	0.70	11	32, 40, 50/40/III SV & RV.
					12	65, 80/40/III SV & RV
					14	100/40/III SV & RV
					13	125, 150/40/III SV & RV
3	4-V-2410-04046	55017700	7	1.40	16	200/40/III SV & RV
					1	2½" 4" - 5000 PSI FBV, 2" FBV

NOTE:

1. COMMON FOR ALL BASIC & ALLIED TYPE NOS. OF RESPECTIVE SIZES OF VALVES.
2. BALLS SHALL BE SUITABLY RUST-PROOFED
3. HARDNESS TO BE 60-66 HRC

00527

393

		HARDENED & TEMPERED.		EN 31 BS 970					
NO. OF PIECES	DESCRIPTION	SEM. PRO. / SEQ. NO.	INT. MAT. / SEQ. NO.	FINAL MATERIAL	SCRAP SORT	NET Wt. (kg)	GROSS Wt. (kg)	DRAWING NO.	ITEM NO.
FIRST ANGLE	SCALE	DRAWN	D. V. Kumar		TOTAL Wt. (kg)				
	NTS	CHECKED	D. K. Pujar		TYPE				
		APPROVED	C. G.						
ALL DIMENSIONS IN MILLIMETRES		DATE	23/9/75		NEW/OLD DRG. No.				
CAUTION THE INFORMATION CONTAINED IN THIS DRAWING IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS, LIMITED. BOILER PLANT UNIT, TIRUCHY-620 014. AND SHALL NOT BE USED WITHOUT THEIR EXPRESS WRITTEN PERMISSION IN ANY FORM OR PART THEREOF FOR ANY OTHER PURPOSE THAN FOR WHICH IT IS INTENDED.				TITLE STEEL BALL					
				DRAWING No.			REVISION		
				4-V-0000-04046			2		
				CARD CODE					
				UOI					

TP-DG-4-V-0000-04046
CORPORATE DRG ID



**PRODUCT ENGINEERING / VALVES ENGINEERING AND R&D
TECHNICAL DELIVERY CONDITIONS FOR
SUBDELIVERY COMPONENTS OF SOOT BLOWERS**

TSB:047

Rev. 03

SHEET NO. **1** of **1**

STEEL BALL

1. Component : Steel Ball 5/32" (4 mm)
2. Material code : 550173970000
3. Application : Used in Wall Deslagger (Wall Blower-WB) and Rotary Blower (RB)
4. Specification :
 - (i) As per drawing No.: 4-V-0000-04046 (SL. No.1)
 - (ii) Material : BS 970 EN31/ A295 GRADE 52100. Hardened and tempered.
 - (iii) Finished balls shall be protected against rust by a suitable grease or oil.
5. Inspection : Inspection to be carried out by BHEL Inspectors at BHEL works for dimensions, finish, hardness and material used.
6. Quantity : 2 Nos per Wall Deslagger and Rotary Blower.
7. Spares : 10% extra to be added as manufacturing reserve and destructive testing.
8. Packing : To be packed and despatched neatly to protect from
9. Weight(~) : 0.26 kg/1000 Nos.

Rev:03 Dt.10/02/2021

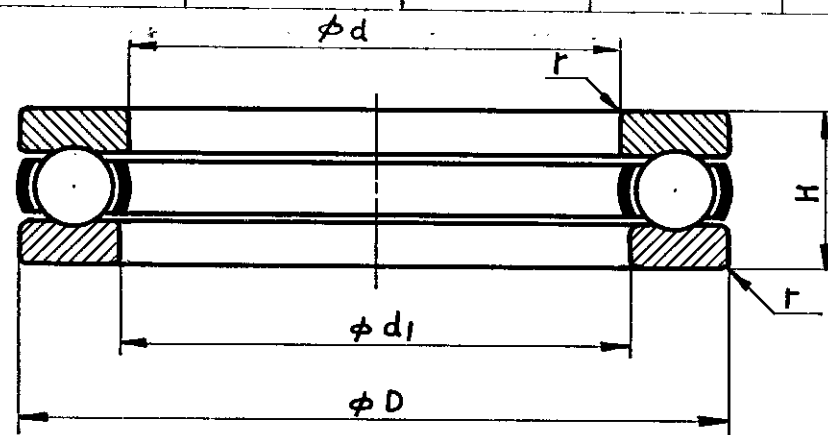
Material details updated.

Prepared By(J SANKAR)

Approved By (R RAKESH)

FIRST ANGLE PROJECTION (ALL DIMENSIONS IN MILLIMETRES)

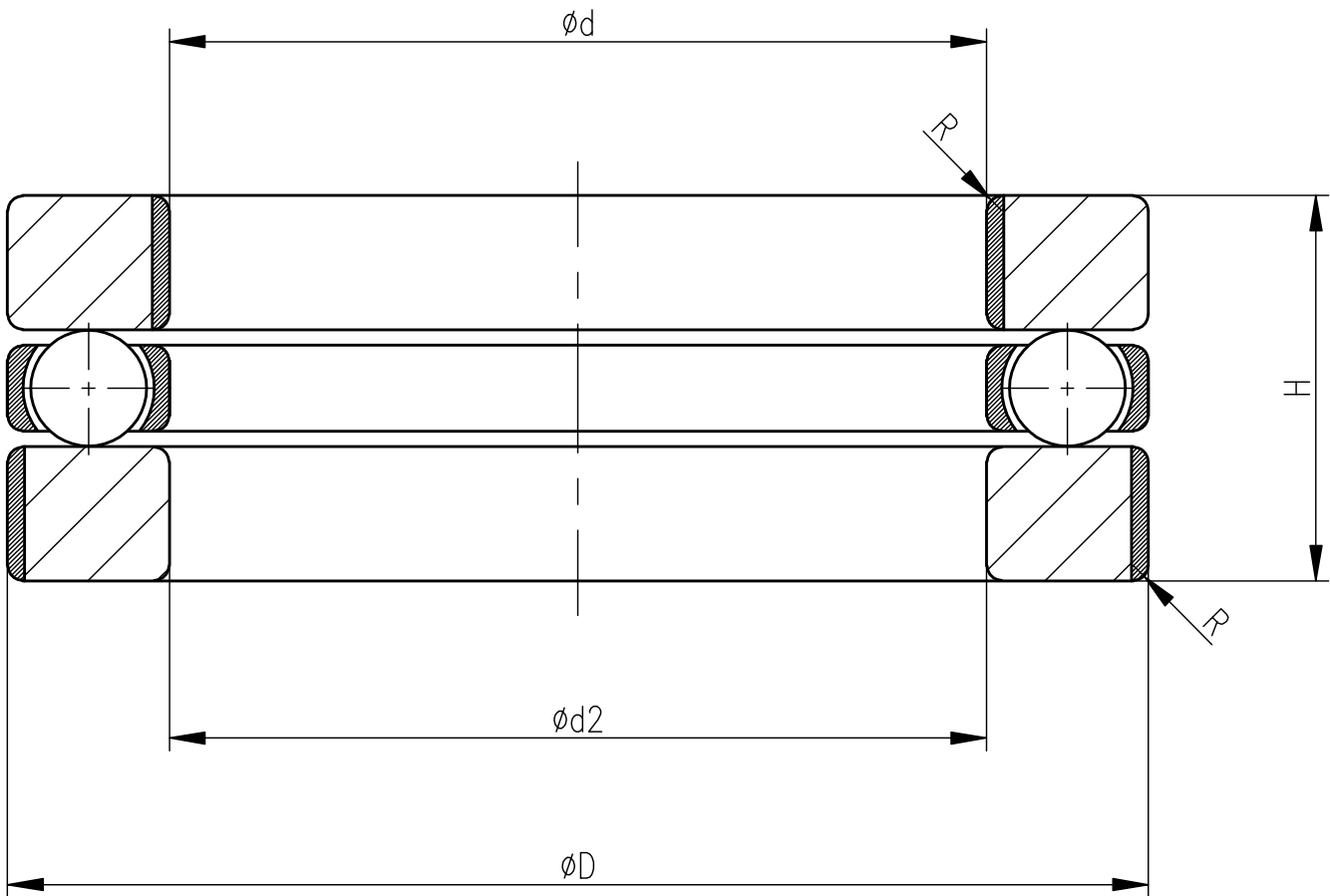
SL.No.	DRAWING No.	BEARING No.	WT IN KGS.	DIMENSIONS					STATIC BASIC CAPACITY - KGS.	MATL. CODE	ACCEPTABLE ALTERNATE BEARING NO.
				ϕD	ϕd	ϕd_1	H	r			
1.	3-V-W001-20050	2910	0.255	74 ^{-0.019}	50 ^{-0.012}	50.2	18	1	7600	96 452 227	—
2.	3-V-W002-20050	912	0.535	90 ^{-0.022}	60 ^{-0.015}	60.2	24.5	1	11700	96 452 228	—
3.	3-V-G003-20050	51214	0.810	105 ^{-0.022}	70 ^{-0.015}	72.0	27	1.5	16100	96 452 229	—
4.	3-V-W003-20050	51216	0.95	115 ^{-0.022}	80 ^{-0.015}	82.0	28	1.5	17700	96 452 230	—
5.	3-V-W004-20050/01	51217	1.29	125 ^{-0.025}	85 ^{-0.020}	88	31	1.5	21400	96 452 231	917
6.	3-V-W113-20050	919	1.59	140 ^{-0.025}	95 ^{-0.020}	95.2	32.5	1.5	30000	96 452 232	—
7.	3-V-W117-20050	920	1.88	150 ^{-0.025}	100 ^{-0.020}	100.2	32.5	1.5	32500	96 452 233	—
8.	3-V-L073-20050	51115	0.42	100 ^{-0.022}	75 ^{-0.015}	77	19	1.5	11100	96 452 693	—
9	3-V-L113-20050	51144	4.57	270 ^{-0.035}	220 ^{-0.030}	223	37	2	62000	96 452 694	—
10	3-V-R009-20050	911	0.72	88 ^{-0.022}	55 ^{-0.015}	55.2	24.5	1	12900	96 452 695	—
11	3-V-W345-20050/01	51210	0.39	78 ^{-0.019}	50 ^{-0.012}	52	22	1	9050	96 452 777	910
12	3-V-W441-20050/01	51213	0.77	100 ^{-0.022}	65 ^{-0.015}	67	27	1.5	15300	96 452 778	913
13	3-V-V065-20050	51212	0.69	95 ^{-0.022}	60 ^{-0.015}	62	26	1.5	14500	96 453 454	
14	3-V-V201-20050	51209	0.32	73 ^{-0.019}	45 ^{-0.012}	47	20	1.5	8500	96 453 455	
15	3-V-V401-20050	51310	1.0	95 ^{-0.022}	50 ^{-0.012}	52	31	2	16400	96 453 456	
16	3-V-V417-20050	51314	2.06	125 ^{-0.025}	70 ^{-0.015}	72	40	2	27600	96 453 457	
17											
18											



REV 06	DATE 20-4-99	ALTRD. KRS K. J. J.	REV 05	DATE 18-8-89	ALTRD. KRS K. J. J.	REV 04	DATE 27-4-88	ALTRD. R. L. R.	 Bharat Heavy Electricals Ltd., BOILER PLANT UNIT TIRUCHIRAPALLI-620 014	DRN	NAME K.N. CHEZHIAN	SIGN	DATE 26/9/94	NO. OF VAR
SL. NO. 13 TO 16 INCLUDED			IN SL. NO. 5, 11 & 12 BEARING NO. CHANGED. DCN. NO. TA 0100			SL. NO. 3, 11 & 12 INCLUDED.				CHD	M. RATKUMAR			
										APPD	V. BABU			
REV 03	DATE 21-5-86	ALTRD. S. K. S.	REV 02	DATE 28-11-86	ALTRD. K. R. SEKAR	REV 01	DATE 17-9-85	ALTRD. K. R. C.	DEPT. VL	GRADE OF UNTOL. DIM	SCALE	WEIGHT (kg)	ITEM NO.	
SL. NO. 10 INCLUDED			SL. NO. 9 INCLUDED.			SL. NO. 8 INCLUDED			CODE 320	1/M/8	NTS			
									TITLE	THRUST BALL BEARING		CARD CODE	DRAWING NO.	REV
												0 01	3-V-0000-20050	06

ALL DIMENSIONS ARE IN MILLIMETRES. FOR TOLERANCES OF UNTOLERANCED DIMENSIONS DURING MANUFACTURE REFER RELEVANT QCP / QP.

88870-0000-A-3
DRAWING NO.



SL No.	DRAWING No.	BEARING No.	WT. in Kgs.	DIMENSIONS					STATIC BASIC CAPACITY-kgs.
				D	d	ød2-MIN	H	R	
01	3-V-0401-02888/01	51101	0.049	26 ⁰ _{-0.013}	12 ⁰ _{-0.008}	12.2	9	0.5	1250
02	3-V-0450-02888/01	51102	0.053	28 ⁰ _{-0.013}	15 ⁰ _{-0.008}	15.2	9	0.5	1370
03	3-V-0402-02888/01	51104	0.088	35 ⁰ _{-0.016}	20 ⁰ _{-0.010}	20.2	10	0.5	2200
04	3-V-0179-02888/01	51107	0.198	52 ⁰ _{-0.019}	35 ⁰ _{-0.012}	35.2	12	1	3900
05	3-V-2387-02888/01	51108	0.265	60 ⁰ _{-0.019}	40 ⁰ _{-0.012}	40.2	13	1	5200
06	3-V-1317-02888/01	51109	0.331	65 ⁰ _{-0.019}	45 ⁰ _{-0.012}	45.2	14	1	5700
07	3-V-0114-02888/01	51111	0.529	78 ⁰ _{-0.019}	55 ⁰ _{-0.015}	55.2	16	1	7650
08	3-V-0112-02888/01	51113	0.750	90 ⁰ _{-0.022}	65 ⁰ _{-0.015}	65.2	18	1.5	9650
09	3-V-0132-02888/01	51114	0.794	95 ⁰ _{-0.022}	70 ⁰ _{-0.015}	70.2	18	1.5	10400
10	3-V-0160-02888/01	51116	0.948	105 ⁰ _{-0.022}	80 ⁰ _{-0.015}	80.2	19	1.5	11600
11	3-V-0181-02888/01	51117	1.010	110 ⁰ _{-0.022}	85 ⁰ _{-0.020}	85.2	19	1.5	12500
12	3-V-1217-02888/01	51217	2.840	125 ⁰ _{-0.025}	85 ⁰ _{-0.020}	85.2	31	1.5	22000
13	3-V-1286-02888/01	51222	5.670	160 ⁰ _{-0.025}	110 ⁰ _{-0.020}	110.2	38	2	37500
14	3-V-1388-02888/01	51218	1.77	135 ⁰ _{-0.025}	90 ⁰ _{-0.020}	90.2	35	--	27000
15	3-V-1510-02888/01	51112	0.29	85 ⁰ _{-0.022}	60 ⁰ _{-0.015}	60.2	17	--	9300
16	3-V-1551-02888/01	51206	0.15	52 ⁰ _{-0.019}	30 ⁰ _{-0.010}	30.2	16	1	4800
17	3-V-9998-02888/01	51305	0.18	52 ⁰ _{-0.019}	25 ⁰ _{-0.010}	25.2	18	1	5100
18	3-V-1552-02888/01	51308	0.55	78 ⁰ _{-0.019}	40 ⁰ _{-0.012}	40.2	26	1.5	11200
19	3-V-9999-02888/01	51407	0.79	80 ⁰ _{-0.020}	35 ⁰ _{-0.012}	35.2	32	1.5	12700
20	3-V-1592-02888/01	51214	0.79	105 ⁰ _{-0.022}	70 ⁰ _{-0.015}	72	27	1.5	16300
21	3-V-L617-02888/00	51110	0.50	70 ⁰ _{-0.019}	50 ⁰ _{-0.010}	52	14	1	6200
22	3-V-L618-02888/00	51105	0.15	42 ⁰ _{-0.016}	25 ⁰ _{-0.010}	26	11	0.5	2900
23	3-V-L603-02888/00	51115	0.95	100 ⁰ _{-0.022}	75 ⁰ _{-0.015}	77	19	1.5	11200

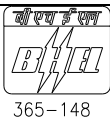
REMARKS:

1. THE TOLERANCES GIVEN FOR ØD & ød ARE APPLICABLE ONLY TO THE DIAMETERS INDICATED BY THE THICK LINES IN THE SKETCH.
2. PREFIX 55211 TO BEARING NOS. TO GET THE MATERIAL CODE.

REV	DATE	ALTERED	P.R.K
		CHD & APPD	S.N.R
DCP:800814		SL.NO 21,22,23 ADDED.	

CAUTION: The information on this document is the property of BHARAT HEAVY ELECTRICALS LTD. It must not be used directly or indirectly in any way detrimental to the interest of the company.

-	-	-	-	-	-	-	-	-	-
S L N o.	DESCRIPTION	MATL CODE	MATL SPECN	HEAT TREATMENT	SCRAP SORT	NET WT (kg)	GROSS WT (kg)	DRAWING No COMP. CODE	ITEM No
TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT									
 BHARAT HEAVY ELECTRICALS LTD., UNIT: HIGH PRESSURE BOILER PLANT. TIRUCHIRAPALLI-620014.					DRN	NAME EC 005	SIGN EC 005	DATE 18.11.82	NO.OF VAR.
					CHD	D. VIJAY	D. VIJAY	18.11.82	
					APPD	V. BABU	V. BABU	22.11.82	
DEPT VL			SCALE N T S	WEIGHT (KG).	REFERENCE INFORMATIONS				NO. OF ITEMS
CODE 320				-					
TITLE THRUST BALL BEARING					CARD CODE U 01	DRAWING NO. 3-V-0000-02888			REV 05



**VALVE ENGINEERING AND R&D
TECHNICAL DELIVERY CONDITIONS FOR
SUBDELIVERY COMPONENTS OF SOOT BLOWERS**

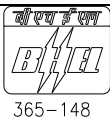
SPEC:SB:002

Rev. 10

SHEET NO. 1 of 2

1.0	COMPONENT	:	BEARING	
1.1	MATERIAL CODES	:	REFER BELOW	
2.0	SPECIFICATION	:	BEARING No.	MATERIAL CODE
2.1	BALL BEARING	:	SKF 6208 2RS (TWO SIDES RUBBER SEALED)	55 119 06208
2.2	BALL BEARING	:	SKF 6209 2RS (TWO SIDES RUBBER SEALED)	55 119 06209
2.3	BALL BEARING	:	SKF 6205 2RS (TWO SIDES RUBBER SEALED)	55 119 06205
2.3a	BALL BEARING	:	SKF 6205 RS	55 111 06205
2.4	BALL BEARING	:	SKF 6204	55 111 06204
2.5	BALL BEARING	:	SKF 6004	55 111 06004
2.6	BALL BEARING	:	SKF 6208	55 111 06208
2.7	BALL BEARING	:	SKF 6019 WITH "C4" CLEARANCE	55 111 06019
2.8	BALL BEARING	:	SKF 6206 2RS (TWO SIDES RUBBER SEALED)	55 119 06206
2.9	BALL BEARING	:	SKF 6206	55 111 06206
2.10	CAM ROL BEARING	:	MC GILL CYR 1 3/8S / IKO CRY22 VUU	97 353 31300
2.11	CAM FOLLOWER	:	MC GILL CF 1S IKO CR 16UU	97 353 93400 96 353 93400
2.12	THRUST BEARING	:	SKF 51101	55 211 51101
2.13	THRUST BEARING	:	SKF 51102	55 211 51102
2.14	THRUST BEARING	:	SKF 52206	55 211 52206
2.15	BALL BEARING	:	SKF 6309	55 111 06309
2.16	BALL BEARING	:	SKF 6202	55 111 06202
2.17	BALL BEARING	:	SKF 6021 WITH C4 CLEARANCE	55 111 06021
2.18	BALL BEARING	:	SKF 6020 WITH C4 CLEARANCE	55 111 06020
2.19	BALL BEARING	:	SKF 6305	55 111 06305
2.20	BALL BEARING	:	SKF 6005-2RS (TWO SIDES RUBBER SEALED)	55 119 06005

Rev:10 Dt.21.07.2020	Clause 7.0 updated.	
Prepared By(J SANKAR)	Checked By (GURPREET SINGH)	Approved By (GURPREET SINGH)



VALVE ENGINEERING AND R&D
TECHNICAL DELIVERY CONDITIONS FOR
SUBDELIVERY COMPONENTS OF SOOT BLOWERS

SPEC:SB:002 Rev. 10

SHEET NO. 2 of 2

2.21	BALL BEARING	: SKF 6210-2RS (TWO SIDES RUBBER SEALED)	55 119 06210
2.22	BALL BEARING	: NDC 88505 LRI 301 KJF (SILICON GREASE LUBRICATED) 6305 ZZ- (SILICON GREASE LUBRICATED)	97 353 30500 96 353 30500
2.23	GUIDE ROLL BEARING	: IKO – NA 6908 UU MC GILL GR 32SS MI – 26	96 366 12400 97 366 12400
2.24	BALL BEARING	: SKF 6008	55 111 06008
2.25	BALL BEARING	: SKF 6017	55 111 06017
2.26	NEEDLE ROLLER BEARING	: SCE 129P	97 366 18500
2.27	BALL BEARING	: 6308-2RS (TWO SIDES RUBBER SEALED)	96 353 63100

3.0 SPECIAL REMARKS :

In addition to the bearing makes indicated against each part codes, bearing shall be procured only from reputed bearing manufacturer or their authorized stockiest. Reputed makes namely SKF / FAG / NACHI / NTN / NSK / RHP / HMT/JNS/INA/AEC (AUSTIN) bearings and any other reputed make with prior approval from Valves Engineering.

4.0 PACKINGS :

Bearings shall be packed in grease packed condition and in oil lubricated paper to avoid rusting before assembly bearings are to be packed in weather proof boxes (wooden) to with stand the transit hazards.

5.0 STORAGE :

To be stored under covered area and the bearings are to be greased and packed if opened.

6.0 CRITICAL CHECK POINTS :

1. Check for dimensions as per the catalogues.
2. Check for damage.
3. Check for radial clearance for the bearings with “C4” clearance.

7.0 DOCUMENTS REQUIRED FOR ACCEPTANCE :

Guarantee certificate to be given by the supplier for a period of 18 months from the date of commissioning or 24 months from the date of dispatch, whichever is earlier.

Rev:10 Dt.21.07.2020

Clause 7.0 updated.

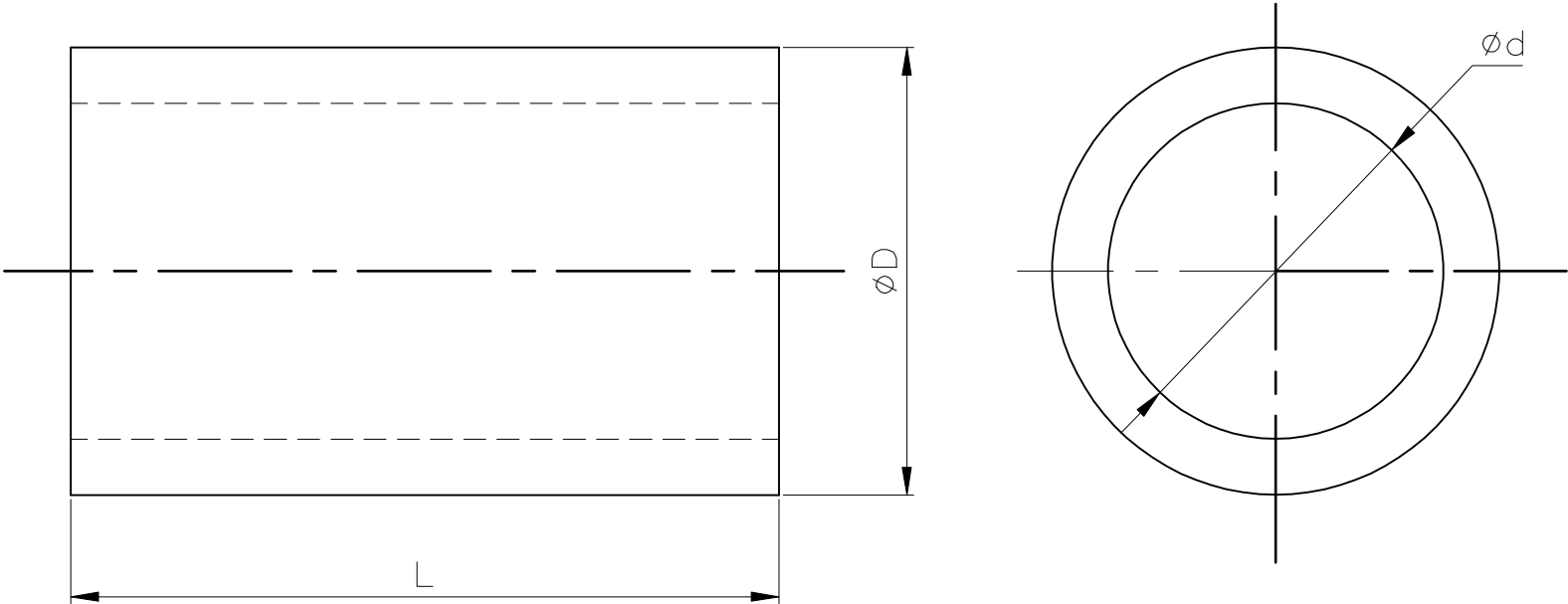
Prepared By(J SANKAR)

Checked By (GURPREET SINGH)

Approved By (GURPREET SINGH)

3-20-001-01223
DRAWING NO.

12.5
▽



VAR NO	ød	øD	L	MATL CODE	WT/100 KGS
01	12.05 ⁰ _{-0.025}	16.05 ^{+0.025} ₀	25.4±0.125	963531510000	1.000
02	12.05 ⁰ _{-0.025}	18.05 ^{+0.025} ₀	15 ±0.125	963531410000	2.000
03	12.548 ⁰ _{-0.025}	16.535 ^{+0.025} ₀	13 ±0.125	963531450000	2.000
04	15.041 ⁰ _{-0.025}	22.002 ^{+0.025} ₀	20 ±0.125	963531440000	3.000
05	15.964 ⁰ _{-0.025}	22.301 ^{+0.025} ₀	16 ±0.125	963530910000	2.500
06	16.043 ⁰ _{-0.025}	18.023 ^{+0.025} ₀	15 ±0.125	963531460000	2.000
07	19.075 ⁰ _{-0.025}	22.301 ^{+0.025} ₀	25 ±0.125	963531380000	4.000
08	20.02 ⁰ _{-0.025}	25.029 ^{+0.025} ₀	32 ±0.125	963531400000	4.500
09	22.314 ⁰ _{-0.025}	28.639 ^{+0.025} ₀	20 ±0.125	963531420000	5.000
10	25.045 ⁰ _{-0.025}	30.00 ^{+0.025} ₀	27 ±0.125	963531470000	7.000
11	25.06 ⁰ _{-0.025}	35.02 ^{+0.025} ₀	38 ±0.200	963531240000	11.000
12	46.00 ^{+0.039} _{0.000}	56.00 ^{+0.051} _{+0.032}	25 ±0.125	963531430000	18.000
13	55.600 ⁰ _{-0.036}	75.270 ^{+0.109} ₀	76 ±0.250	963534650000	36.000
14	63.600 ⁰ _{-0.036}	75.270 ^{+0.109} ₀	76 ±0.250	963534660000	34.000
15	28.626 ⁰ _{-0.025}	34.976 ^{+0.025} ₀	25 ±0.125	963533080000	12.000

NOTES:

- MATERIAL SINTERED BRONZE CONFORMING TO IS:3980XX GRADE1 CLASS A
- MANUFACTURE AND WORKMANSHIP : THE BUSHES SHALL BE MADE BY PRESSING AND SINTERING METAL POWDER SO AS TO PRODUCE FINISHED PARTS. THE BEARINGS SHALL BE UNIFORM IN COMPOSITION AND FREE FROM DEFECTS WHICH WOULD AFFECT THEIR SERVICEABILITY.
- THE BUSHES SHALL BE PRE LUBRICATED WITH OIL IMPREGNATED.

REV	DATE	ALTERED	K.S
01	9.11.04	CHD & APPD	S.N
DRG. UPDATED & REDRAWN. DMN. 46 ^{+0.039} _{+0.000} & 56 ^{+0.051} _{+0.032} WERE 44.526 ^{+0.000} _{+0.040} & 55.226 ^{+0.040} _{+0.000} RESPLY. DCN.NO: 800386			

CAUTION: The information on this document is the property of BHARAT HEAVY ELECTRICALS LTD. It must not be used directly or indirectly in any way detrimental to the interest of the company.

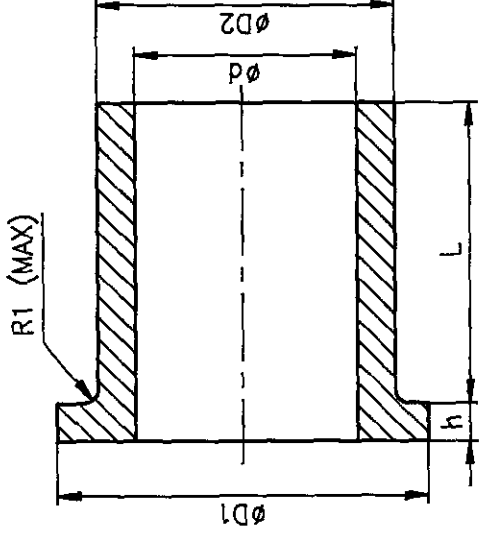
NO OFF	DESCRIPTION	MATL CODE	MATL SPECN	HEAT TREATMENT	SCRAP SORT	NET WT (kg)	GROSS WT (kg)	DRAWING No	ITEM No	
TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT										
BHARAT HEAVY ELECTRICALS LTD. UNIT: HIGH PRESSURE BOILER PLANT. TIRUCHIRAPALLI_620014.						DRN	NAME S.NAPPI	SIGN S.N	DATE 09.11.04	NO.OF VAR.
365-121						CHD	K.SRIDHARAN	K.S	09.11.04	
DEPT SB						APPD	S.NATARAJAN	S.N	09.11.04	
CODE 330	SCALE NTS	WEIGHT (KG). -		REFERENCE INFORMATION				NO. OF ITEMS		
TITLE SINTERED BRONZE BUSH						CARD CODE U 01	DRAWING NO. 3-20-001-01223			REV 01

CAUTION: The information on this document is the property of BHARAT HEAVY ELECTRICALS LTD. It must not be used directly or indirectly in any way detrimental to the interest of the company.

FOR TOLERANCES OF UNTOLERANCED DIMENSIONS

REV	DATE	ALTERED
		CHD & APPD

ALL DIMENSIONS ARE IN MILLIMETRES.
DURING MANUFACTURE REFER RELEVANT QCP/QP



VAR NO	ϕd	$\phi D1$	$\phi D2$	L	h	MATL CODE	WT/100 KGS
01	8 $\begin{smallmatrix} +0.022 \\ 0 \end{smallmatrix}$	19 ± 0.013	11 $\begin{smallmatrix} +0.029 \\ +0.018 \end{smallmatrix}$	13 ± 0.013	1.5 ± 0.050	963531500000	1.000
02	20 $\begin{smallmatrix} +0.020 \\ -0.030 \end{smallmatrix}$	28 ± 0.060	25 $\begin{smallmatrix} +0.062 \\ -0.041 \end{smallmatrix}$	19 ± 0.100	2.5 $\begin{smallmatrix} +0.300 \\ 0 \end{smallmatrix}$	963531480000	5.000

NOTES:

01. MATERIAL

VAR NO 01 PTFE FILLED WITH GLASS.

VAR NO 02 SINTERED BRONZE CONFORMING TO IS:3980XX GRADE1 CLASS A

OIL IMPREGNATED.

02. THE BUSHING SHALL BE UNIFORM IN COMPOSITION AND FREE FROM DEFECTS WHICH WOULD AFFECT THEIR SERVICEABILITY.

NO OFF	DESCRIPTION	MATL CODE	MATL SPECN	HEAT TREATMENT	SCRAP SORT	NET WT (KG)	GROSS WT (KG)	DRAWING No	ITEM NO
BHARAT HEAVY ELECTRICALS LTD., UNIT: HIGH PRESSURE BOILER PLANT. TRUCHIRAPALLI 620014.		DRN	VARUMUGAM	SIGN	DATE	NO. OF VAR			
		CHD	N.GANESAN	N. Ganesh	27-2-96				
		APPD	G.S. HAMEED	G.S.H.	27-2-96				
DEPT SB		SCALE		WEIGHT (KG)		REFERENCE INFORMATION		NO. OF TIES	
CODE 330		NTS		-		TSB 028			
TITLE		CARD CODE		DRAWING NO.		REV			
FL, SINTERED BUSH.		U 01		4-20-001-02393		00			

Size A4



BHARAT HEAVY ELECTRICALS LIMITED

VALVES PURCHASE

MOU/TP-VALVE/VALVE GEAR BOX/ REV 05
DATE:17.07.2018

Page 1 of 12

TECHNICAL SPECIFICATION

FOR SUPPLYING

VALVES GEAR BOXES



BHARAT HEAVY ELECTRICALS LIMITED

VALVES PURCHASE

MOU/TP-VALVE/VALVE GEAR BOX/ REV 05

DATE:17.07.2018

Page **2** of **12**

Contents

Scope

- 1.0 General conditions
- 2.0 Technical requirements
- 3.0 Documentation requirements
- 4.0 Quality requirements
- 5.0 Additional Details required



BHARAT HEAVY ELECTRICALS LIMITED

VALVES PURCHASE

MOU/TP-VALVE/VALVE GEAR BOX/ REV 05

DATE:17.07.2018

Page 3 of 12

SCOPE

By this MOU, The specification for the Valve gearboxes is mutually agreed and applicable for the purchase orders finalised against the valve gearbox requirements from BHEL/Trichy during the period of validity of this MOU.

Project / order specific requirements will be indicated with each items of the order. However this specific requirement is over and above the specification finalized in this MOU.



BHARAT HEAVY ELECTRICALS LIMITED

VALVES PURCHASE

MOU/TP-VALVE/VALVE GEAR BOX/ REV 05

DATE:17.07.2018

Page 4 of 12

1.0 General requirements

- 1.1 During the validity of this MOU, only MOU specification will be applicable for all enquiries and it will not be discussed for any deviation/clarification etc.
- 1.2 In case of the conflict in any requirement between MOU and project specific specification, the requirement of the project section is the final and binding.
- 1.3 It is agreed that no deviations will be taken by the vendors on the specification while submitting their offers against future enquiries.
- 1.4 Since this MOU specifications is standardized and an understanding has been reached, the future enquiries will be floated on "SINGLE BID SYSTEM" only. Hence, if any offer is found with deviations, the same will be totally rejected and will not be considered for further evaluation
- 1.5 The validity of this MOU is for TWO years from the date of signing. After the expiry of the period, the same can be extended further with or without any modifications. However, in case any changes are required, the MOU may be amended before the expiry of the validity.
- 1.6 If any special or non-standard tools are required for installation, operation or maintenance, the same shall be supplied along with the equipment.
- 1.7 Trouble-free operation of the equipment shall be guaranteed for a period of 12 months from the date of commissioning OR 18 months from the date of dispatch whichever is earlier.
- 1.8 Since the vendors works alone is approved by BHEL, it is agreed the vendor will manufacture this item in their own works only and will not off-load the jobs to any other suppliers without the written approval by BHEL.
- 1.9 All components shall be packed in such a way that they should not get damaged during transport.
- 1.10 BHEL and the Vendor shall have an involvement which will commence at bid stage and follow through the completion and acceptance, thus ensuring total conformity to Purchaser's requirements.



BHARAT HEAVY ELECTRICALS LIMITED VALVES PURCHASE

MOU/TP-VALVE/VALVE GEAR BOX/ REV 05

DATE:17.07.2018

Page 5 of 12

2.0 Technical Requirements

PRODUCTENGINEERING/VALVES	VAL/BG/SPEC/006Rev.:04
BHEL/TIRUCHIRAPPALLI-14	DATE:16-05-2018

SPECIFICATION FOR BEVEL GEAR OPERATORS FOR VALVES

1. **TYPE:**

All gear operators shall have bevel gear transmission with completely enclosed construction complying to IP65 or better. The gear casing shall be designed adequately to withstand shock and vibration of the pipeline. The design shall be compact and less weight and shall not cause any trouble during operation at sites.

2. **LUBRICANT:**

The Gearbox shall be filled with suitable lubricant. The specification of lubricant shall be furnished. There shall be no leakage of lubricant from the gearbox. The grease used shall be suitable for an ambient temperature of 80 deg. Centigrade.

2. **HANDWHEEL:**

All the gear operators shall have suitable hand wheel and the size of the hand wheel shall be designed to give the required input torque. The hand wheel shall be malleable iron or steel. The maximum hand wheel diameter shall not be more than 750mm.

3. **BASE:**

The gear operator shall have base suitable to take the thrust with ball/roller bearings. An Aluminum Bronze drive sleeve with a pilot bore shall be provided as a standard supply. If specified in the Purchase Order, Ni-Resist drive sleeve is to be supplied. The drive sleeve will be threaded by BHEL to suit the stem thread.

4. **ASSEMBLY:**

The assembly of all gears, shafts etc... shall be done properly to have smooth operation without any noise. Also the Gearboxes shall be suitable for mounting in any position.

5. **OUTPUT SHAFT FLANGE:**

The flange for connecting the valve shall have dimensions as per BHEL requirement indicated in the table.



BHARAT HEAVY ELECTRICALS LIMITED

VALVES PURCHASE

MOU/TP-VALVE/VALVE GEAR BOX/ REV 05

DATE:17.07.2018

Page 6 of 12

6. INPUT SHAFT FLANGE:

Wherever gearboxes are required to be assembled with Electrical Actuator, Gear operators are to be supplied with input flanges to suit the keyed shaft of the actuator. Details of the input flange for each model shall be furnished. Applicable Actuator models that can be coupled with each Gearbox shall also be indicated.

7. RANGE:

The gear operators with torque, thrust, maximum stem acceptance diameter, base details, etc., shall be supplied as per the details given below.

Sr.No.	Torque (kg -m) – Max.	Thrust (kgf)	Max. Stem Dia (mm)	Flange OD (mm)	Bolt Circle Dia (mm)	Locating Dia (mm) h7	Threaded hole size(mm)	Threaded hole depth(mm)	No. of Holes	Handwheel dia (mm)	Gear Ratio	Stem cover length(slotted)(m)
1	11	2700	40	125	102	70	M10x1.5	16	4	250	2:1	200
2	35	6300	46	178	139.7	95.2	M16x2	26	4	310	2.5:1	250
3	50	16000	52	178	139.7	95.2	M16x2	22	4	310	4:1	250
4	75	10000	55	210	165.1	127	M20x2.5	26	4	460	3:1	250
5	100	19000	65	210	165.1	127	M20x2.5	30	4	460	4:1	250
6	150	20000	65	289	254	152.4	M16x2	34	8	460	4:1	400
7	200	32000	86	289	254	152.4	M16x2	25	8	460	6:1	400
8	300	35000	85	343	298.5	177.8	M20x2.5	31	8	610	6:1	400
9	400	45000	102	343	298.5	177.8	M20x2.5	25	8	610	8:1	400
10	600	63000	115	412	355.6	215.9	M24x3	45	8	610	8:1	400
11	800	82000	121	406	355.6	215.9	M24x3	30	8	610	8:1	400
12	1200	120000	130	476	406.4	228.6	M30x3.5	50	8	750	10:1	500
13	1600	135000	170	476	406.4	228.6	M30x3.5	50	8	750	10:1	500

Engineering

Purchase

Quality

Vendor



BHARAT HEAVY ELECTRICALS LIMITED

VALVES PURCHASE

MOU/TP-VALVE/VALVE GEAR BOX/ REV 05

DATE:17.07.2018

Page 7 of 12

8. **MATERIAL:**

All machined components like bevel gear, bevel pinion, drive sleeve etc., shall be from superior grade material suitable for the application and shall be heat treated to the design requirement.

9. **STEM PROTECTION:**

All gear operators shall have stem protection covers. Stem protection covers are to be provided with a 'SLOT' for stem position indication. The length of stem protection cover shall be as indicated in the table. Wherever different length of stem protection cover is required, the same has to be supplied as indicated in the purchase order. The thread connection of the Stem Protection Cover shall be indicated in the GA drawing & Catalogue.

10. **DRAWING:**

Supplier to furnish the general arrangement drawing and cross sectional drawing of the gear operator incorporating the material specification for all critical components and overall dimensional details for BHEL approval. Also complete dimensional drawing of drive sleeve is to be furnished for all models.

11. **TYPE TESTS:**

The gear operator shall be tested to the design requirement of torque and thrust and type test certificates shall be furnished. The mechanical efficiency shall not be less than 95%.

12. **FINAL ASSEMBLY:**

To be inspected visually for surface smoothness, painting finish and smooth operation.

13. **NAME PLATE:**

Nameplate made of suitable corrosion resistant material, preferably stainless steel, is to be fixed on to the gearbox casing. The name plate contain the following information as minimum:

Maker's Name.....:
Model Number:
Serial Number:
Output Torque.....:
Permissible Thrust.....:
Gear Ratio.....:
Material Code(as indicated in P.O).:



BHARAT HEAVY ELECTRICALS LIMITED VALVES PURCHASE

MOU/TP-VALVE/VALVE GEAR BOX/ REV 05
DATE:17.07.2018

Page 8 of 12

14. **VENDOR TO FURNISH THE FOLLOWING DETAILS:**

Name of Supplier.....:
Gear Box Model No.:
G.A. Drawing No.....:
Cross sectional Drg. No.:
Drive sleeve Drg. No.....:
Lubricant Details:
Bearing details.....:
Suitability for Outdoor Application.... :

The vendor shall furnish the above details against each model of the Gearbox offered and enclose all the drawings & documents along with the offer.

15. **Recommended spares:**

The supplier shall indicate the list of commissioning spares if any and operational spares for five years of trouble free operation.



BHARAT HEAVY ELECTRICALS LIMITED

VALVES PURCHASE

MOU/TP-VALVE/VALVE GEAR BOX/ REV 05
DATE:17.07.2018

Page 9 of 12

3.0 Documentation Requirements

The following documents are to be attached with this MOU
a. GA drawings for all models including dismantling clearances.
b. The dimension drawing of the blank adopter bush
c. Dimensional catalogue with maximum spindle acceptance details
d. Outline dimension of gear box.
e. General arrangement drawing of gear box consisting following as minimum
1. Identification of critical component with its material composition.
2. Mounting flange dimension
3. Hand wheel dimensions
4. Weight of gear box
5. Stem protection cover length, thread size and type
f. The 3D CAD format shall be available for all the models.
g. Quality plan.
h. Valid Type test certificates



BHARAT HEAVY ELECTRICALS LIMITED

VALVES PURCHASE

MOU/TP-VALVE/VALVE GEAR BOX/ REV 05

DATE:17.07.2018

Page 10 of 12

4.0 Quality requirements

4.1 INSPECTION AND TEST REQUIREMENTS

All equipments shall be subject to inspection by BHEL/ Client and/or their nominated inspecting authority. Vendor shall make all provisions in his shop/sub-vendors shops for complete inspection and test of gear boxes

4.2 Tests & Inspection:

- 4.2.1 During fabrication/testing, the gearboxes shall be subjected to inspection by BHEL/CUSTOMER or by any agency authorized by them. Manufacturer shall furnish all necessary information concerning the supply to BHEL/CUSTOMER inspectors.
- 4.2.2 All routine tests as specified by the applicable standards shall be conducted.
- 4.2.3 Shop tests shall be witnessed by an inspector of BHEL/CUSTOMER or of an agency authorized by customer.
- 4.2.4 Quality plan for the gear boxes to be followed.

4.3 Painting, Protection, Packing, Supply and Identification:

4.3.1 **Surface Preparation:** Weld slag & spatter shall be removed and the surfaces to be coated shall be free from contamination. Surface defects shall be removed by suitable methods. Sharp edges shall be smoothened by grinding. Prior to surface preparation oil, grease, drilling emulsions, cutting emulsions and preservative agents shall be carefully removed by suitable solvents. The surface shall be carefully dried with clean cloth to prevent the dissolved impurities from spreading over the entire surface. The surface shall be cleaned by wire brush and shot blasting if required. Proper adhesiveness of paint to the surface shall be ensured.

4.3.2 Paint Shade

The enclosures shall be treated and prepared for painting with suitable painting system for withstanding 500Hrs of salt spray as per ASTM B-117/ ISO 9227 standard.
Paint shade shall be 'shade 692 of IS 5 (Smoke Grey)'

4.4 Packing & Transport:

The gearbox shall be supplied to site packed in wooden crates / Carton boxes. They shall be wrapped with polythene sheets. They shall have skid bottoms for handling.



BHARAT HEAVY ELECTRICALS LIMITED

VALVES PURCHASE

MOU/TP-VALVE/VALVE GEAR BOX/ REV 05

DATE:17.07.2018

Page 11 of 12

All spares shall be packed separately in boxes marked SPARE. Special precaution notations such as Fragile. This side up, center of gravity, weight, and Owner's particulars. Purchase number etc. shall be clearly marked on the package together with other details as per purchase order.

The equipment may be stored in a covered shed for long periods before installation. The packing should be suitable for such storage.

4.T.0	TEST REQUIREMENTS FOR GEAR BOXES
4.T.1.0	ROUTINE TEST:
4.T.1.1	Dimensions: Overall and mounting
	Details of painting as per specification: Anti-corrosiveness Epoxy.
	i. Shade.
	ii. Finish
4.T.1.2	iii. Paint thickness
4.T.1.3.	Manual operation through hand wheel.
4.T.1.10	T.1.10 Leakage test for gear case (visual).
4.T.2.0	TYPE TEST certificates shall be provided for Thrust & Torque
4.T.2.5.	Enclosure protection for the total assembly.
4.N.0.	NOTES:
4.N.0.1.	The quality plans shall be approved by BHEL.
4.N.0.2.	All testing facilities shall be arranged by the vendor, at his works before calling BHEL representative for inspection.
4.N.0.3.	Approved drgs., PO specification and relevant standards if any shall be made available during testing / inspection.
4.N.0.4.	All measuring and testing instruments shall be periodically calibrated from National test house and certificates made available during inspection.
4.N.0.5	All relevant GA drawings, data sheets & wiring diagrams shall be submitted as controlled copy and approval shall be obtained from BHEL. All supply shall be as per these documents.



BHARAT HEAVY ELECTRICALS LIMITED

VALVES PURCHASE

MOU/TP-VALVE/VALVE GEAR BOX/ REV 05

DATE:17.07.2018

Page 12 of 12

5.0 Additional Details required

The following details are required for Gear operators in addition to Technical requirements mentioned in **VAL/BG/SPEC/006 Rev.:04**

1. For gearboxes of Torque range 150KGM and less (S.no 1 to 6 of technical specification "Range" table), operating force required on hand wheel at full torque output shall not exceed 35 Kg F while operating with both hands. Accordingly, gearbox ratios shall be selected.
2. All gearboxes shall be provided with Hammer blow effect.
3. All Gear operators shall have provision to accommodate raising spindle of the valve and the hole shall be properly covered with a removable lid. The Gear box shall be supplied with stem protection tube to accommodate larger spindle travel as indicated elsewhere in this specification. All the above parts, i.e. the threaded portion of Gear box, removable lids and stem protection tubes shall be able to withstand the prolonged outdoor storage without getting rusted or damaged.
4. All Gears used shall be metallic. Fiber gears are not acceptable. Metallic gear trains used shall be self-locking to prevent drift.
5. The gearbox shall be oil filled or grease filled. The oil/grease must be suitable for operation for 80 Deg. above ambient temperature. Furnish detail of lubricant used with Indian oil Company's BPCL, IOCL & HPCL's equivalent. The Gear box shall have proper seals to prevent leakage of oil at all installation positions. The Gear box construction shall be such that the oil/grease does not leak to other compartments or outside. In case of any complaint of such leakage, the complaint shall be attended free of cost within one week and root cause of the problem shall be eliminated within one month.
6. All gearboxes shall be suitable for both Hand operation and motor operation (for actuator combination).
7. Supplier shall quote for the applicable mandatory spares which will be used for spares requirement during rate contract period.



365-147/B
31.08.16

BHEL – Tiruchirappalli –
620014, India

Valves Engineering and R&D

PURCHASE SPECIFICATION

DOC No: **SPEC:CV:0013** Rev: 00

Effective Date: **11/02/2023**

Page: **1** of **11**

Product: Double Acting Pneumatic Actuators with Manual Override

Revision Record:

Rev. No	Date	Details of Revision
00	11 February 2023	First Release / issue

Contents

1.	General	2
2.	Application	2
3.	Scope	2
4.	Design	2
4.1.	General	2
4.2.	Pneumatic Actuator	2
4.3.	Limit Switch	3
4.4.	Junction Box	3
4.5.	Name plate has to contain following details	3
4.6.	Inspection	3
4.7.	Painting	3
4.8.	Spares	3
4.9.	Packaging and Dispatch	4
4.10.	Additional Requirements	4
5.	Document Requirements	4
5.1	Offer Documents	4
5.2	PO Documents	4



365-147/B
31.08.16

BHEL – Tiruchirappalli –
620014, India

Valves Engineering and R&D

PURCHASE SPECIFICATION

DOC No: **SPEC:CV:0013** Rev: 00

Effective Date: **11/02/2023**

Page: **2** of **11**

Product: Double Acting Pneumatic Actuators with Manual Override

1. General

This specification covers the requirements for the design, materials, construction details, manufacture, inspection, and testing of double-acting pneumatic actuators. The offer shall be submitted along with all the documents mentioned in this specification.

- 1.1. The design, material, construction, manufacture, inspection and testing of actuators shall conform to the latest applicable codes and standards.
- 1.2. Nothing in this Specification shall be construed as relieving the Bidder of his responsibility for compliance with all applicable codes and regulations.

2. Application

The actuator supplied shall be fitted on the gate valves to be used in Wet Limestone based Flue Gas desulphurization plant for process water application.

3. Scope

Scope of supply shall include Pneumatic actuator with mounting yoke (for Pneumatically Actuated Gate Valve) + Manual Override with Pneumatic Accessories with the parameters and mounting dimensions indicated in the relevant part of this specification. Manual override (gear) operators shall be provided to open/close the actuator such that the effort required to operate the handwheel with both hands does not exceed 35 kgf at max load conditions.

4. Design

4.1. General

The actuators shall be designed to operate Gate Valves of rising stem type and shall have limit switches for full OPEN and full CLOSED indication. (In such cases, the Limit switches shall form an integral part of the actuator yoke).

Details of actuators covered under this specification are given in Annexure-A.

4.2. Pneumatic Actuator

(All tubings and mentioned accessories are to be pre- assembled at vendor works)

- 4.2.1. Rising stem, Pneumatic Double acting cylinder to be designed for minimum 4 kg/sq.cm.
- 4.2.2. Seals used in Pneumatic Actuator cylinder should be of "VITON"
- 4.2.3. Wear Strip of Pneumatic actuator cylinder should be EPDM- vendor to confirm.
- 4.2.4. Solenoid valve should be of renowned make – Rotex, Asco. Any other make shall be subjected to BHEL approval.



365-147/B
31.08.16

BHEL – Tiruchirappalli –
620014, India

Valves Engineering and R&D

PURCHASE SPECIFICATION

DOC No: **SPEC:CV:0013** Rev: 00

Effective Date: **11/02/2023**

Page: **3** of **11**

Product: Double Acting Pneumatic Actuators with Manual Override

- 4.2.5. Junction Box: To be fitted on the actuator yoke.
- 4.2.6. Filter regulator mounting to be in vertically downward direction so that Drain will Drop toward the ground & to be mounted on the cylinder.
- 4.2.7. All Pneumatic accessories and fitting to be compactly arranged along with Pneumatic Actuator.
- 4.2.8. All threading of pneumatic fitting shall be "NPT".
- 4.2.9. All tubing and fitting shall be of SS material only.

4.3. Limit Switch

- 4.3.1. 2 nos. of DPDT (2 NO + 2NC) limit switch are to be provided, 1 for open and 1 for close position.

4.4. Junction Box

- 4.4.1. One termination junction box(JB) to be provided with Minimum 24 terminal (600V grade) proper lugs & cable glands.
- 4.4.2. In the JB, all Cable glands are to be mounted such that water should not enter.
- 4.4.3. Cable: All Wirings from limit switches, solenoid valve to JB with proper cable gland shall be pre-assembled at vendor works.
- 4.4.4. Working voltage: Refer Wiring diagram in Annexure –A.
- 4.4.5. 7 nos. Cable Glands to be provided. Refer Wiring diagram in Annexure –A for Size and Cable size.

4.5. Name plate has to contain following details as minimum.

- 4.5.1. Drive cylinder bore/stroke (mm).
- 4.5.2. BHEL material code (Indent No / P.O. Ref.)
- 4.5.3. Year and month of manufacture and serial number.
- 4.5.4. Actuator weight in kg.

4.6. Inspection

Inspection shall be as per the approved Quality Plan.

4.7. Painting

Painting Specifications will be provided along with Purchase Order.

4.8. Spares

Each set shall be suitably packed and supplied along with the actuator as loose supplies

- 4.8.1. 2 Nos of Limit Switches for each actuator shall form part of supply.
- 4.8.2. One complete set of seals and elastomers for each actuator shall form part of supply.



365-147/B
31.08.16

BHEL – Tiruchirappalli –
620014, India

Valves Engineering and R&D

PURCHASE SPECIFICATION

DOC No: **SPEC:CV:0013** Rev: 00

Effective Date: **11/02/2023**

Page: **4** of **11**

Product: Double Acting Pneumatic Actuators with Manual Override

4.9. Packaging and Dispatch

- 4.9.1. Actuators shall be covered in suitable water-proof packing and packed suitably in wooden cases in order to avoid damage during transit and also during storage at plant.
- 4.9.2. The Bidder shall adequately crate, block, anchor and protect equipment as required to prevent damage during overseas shipment and outdoor storage for a period of one (1) year.
- 4.9.3. All threaded connections shall be plugged or capped with standard pipe plugs or caps.
- 4.9.4. PO number, vendor name, item size, material code, model number, Quantity inside the box to be mentioned outside the packing box.

4.10. Additional Requirements

- 4.10.1. Only latest revision shall be referred for all the Standards specified.

5. Document Requirements

5.1 Offer Documents

The following documents shall be part of offer:

- 5.1.1. Point wise acceptance and deviations (if any) of this specification.
- 5.1.2. If the bid submitted has got any deviation from this technical specification, the bidder shall furnish full particular of such deviations. Deviations are to be furnished with specific mention to clause number. Only such deviations will be discussed and resolved. Reasons / explanation for such deviations shall be furnished. Any other notes / comments viz. "refer to forwarding letter" etc. is not acceptable.
- 5.1.3. If there is no deviation from this specification, the Bidder shall indicate as "**NO DEVIATIONS**".
- 5.1.4. General arrangement drawing with interface dimensions, Bill of Materials with Material Specification.
- 5.1.5. Vendor to furnish the actuator thrust selection calculation for each cylinder with offer.
- 5.1.6. Vendor to provide Actuator Data Sheet along with offer as per **Annexure-B**. Only bids with Technical details completely filled as per this annexure will be considered for evaluation.
- 5.1.7. The Actuator model along with catalogue to be furnished with exploded view highlighted with recommended seal kit and repair kit. Drawings for Mechanical Seal to be provided.
- 5.1.8. List of Commissioning spares required & it's make and model number. Its cost to be included in the main offer as a separate item.
- 5.1.9. Vendor to submit duly filled, sealed & signed all pages.

5.2 PO Documents

The following documents shall be provided after placement of order:



365-147/B
31.08.16

BHEL – Tiruchirappalli –
620014, India

Valves Engineering and R&D

PURCHASE SPECIFICATION

DOC No: **SPEC:CV:0013** Rev: 00

Effective Date: **11/02/2023**

Page: **5** of **11**

Product: Double Acting Pneumatic Actuators with Manual Override

- 5.2.1 Cross-sectional drawings to be provided after PO placement.
- 5.2.2 Detailed Quality Plan to be submit for BHEL approval after PO placement.
- 5.2.3 All GA Drawings including bill of material with quantity and make & model of Sub-Delivery Components, Pneumatic & Electrical Circuit Diagram and Quality Plan required during offer stage also.
- 5.2.4 All GA Drawings shall contain PO and PO item number.
- 5.2.5 Shipment weight & volume details.
- 5.2.6 Equipment preservation procedure during shipment, pre-erection storage period & extended storage period.
- 5.2.7 Operation, Maintenance and Erection manual consisting of details of all components and catalogues for bought out items - 1 hard copy and 1 soft copy after placement of order.



365-147/B
31.08.16

BHEL – Tiruchirappalli –
620014, India

Valves Engineering and R&D

PURCHASE SPECIFICATION

DOC No: **SPEC:CV:0013** Rev: 00

Effective Date: **11/02/2023**

Page: **6** of **11**

Product: Double Acting Pneumatic Actuators with Manual Override

Annexure-A

SI No.	Valve Size	Thrust KgF	Approx. Stroke	GLAND FLANGE-B	FLANGE THICKNESS-T	PNEUMATIC YOKE FLANGE ID	PCD	BOLT SIZE	No. OF BOLTS-N	STEM HEIGHT-H	THREAD LENGTH-T1	DIA INCH N ACME 2G-LEFT	MATERIAL CODE
1	100	1030	130	135	26	150	225	M24	4	100	38	1.000"-5 ACME	969991902000
2	125	1800	175	145	26	160	225	M24	4	100	43	1.125"-5 ACME	969991902100
3	150	1800	175	145	26	160	225	M24	4	100	43	1.125"-5 ACME	969991902100
4	200	2750	230	155	26	170	230	M24	4	120	48	1.25"-4 ACME	969991902200
5	250	4300	280	180	26	200	275	M24	4	125	52	1.375"-4 ACME	969991902300
6	300	4685	340	180	26	200	275	M24	4	140	57	1.5"-4 ACME	969991902400

- Actuator Stroke shall be measured by the length of piston movement outside the actuator



365-147/B
31.08.16

BHEL – Tiruchirappalli –
620014, India

Valves Engineering and R&D

PURCHASE SPECIFICATION

DOC No: **SPEC:CV:0013** Rev: 00

Effective Date: **11/02/2023**

Page: **7** of **11**

Product: Double Acting Pneumatic Actuators with Manual Override

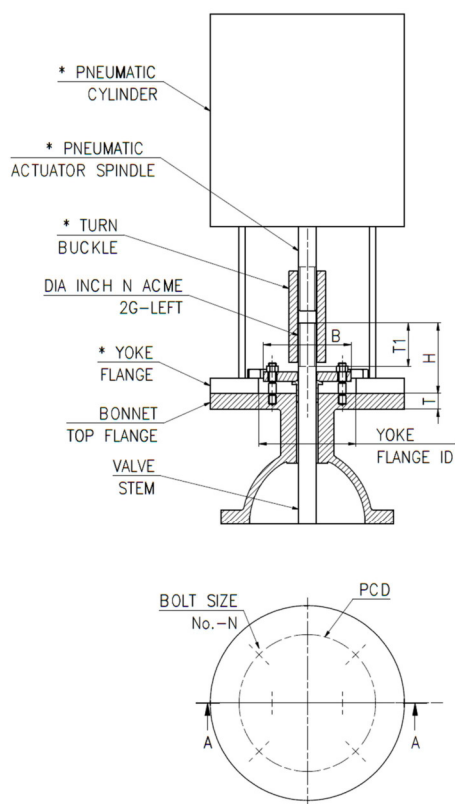


Fig – A

NOTE: * Marked items as mentioned in Fig-A are under Vendor Scope.



365-147/B
31.08.16

BHEL – Tiruchirappalli –
620014, India

Valves Engineering and R&D

PURCHASE SPECIFICATION

DOC No: **SPEC:CV:0013** Rev: 00

Effective Date: **11/02/2023**

Page: **8** of **11**

Product: Double Acting Pneumatic Actuators with Manual Override

Annexure-B

ACTUATOR DATA SHEET			
S.No.	Parameter	Value	Yes/No
Valve Details (*Refer Annex-A)			
1	*Valve Size		
2	*Thrust required for Valve (Kgf)		
3	*Stroke (mm)		
4	*Stem Thread Size		
5	Rising Stem	Yes	For info
Valve-to-Actuator Interface (Refer Fig-A)			
6	Yoke along with Flange	Required	
7	Yoke Material		
8	*Yoke Flange ID (mm)		
Actuator Spindle Connection with Valve Stem (Refer Fig-A)			
9	Connection Type	Turnbuckle	
10	Stroke Adjustment in Turnbuckle	± 10 mm	
Actuator Data			
11	Actuator Mounting Position	Vertical	
12	Actuator Type	Pneumatic	
13	Spring Action	Double Acting	
14	Allowed Temperature (°C)	100	
15	Manual Override	Required	
16	Lifting Hooks	Required	
17	Power Failure Position	Stay Put	
18	Air Failure Position	Stay Put	
19	Location Position Indicator	Required	
20	Full Open / Full Close	Required	
21	Air Supply Pressure (4 - 6 kg/cm ²)		
22	Air Input Connection Size (NPT)		
23	Actuator Thrust at Output (Kgf)		
24	Actuator Stroke at Output (mm)		
25	Operating Time (Sec)		
Actuator Cylinder and Piston Data			
26	Cylinder Diameter (mm)		



365-147/B
31.08.16

BHEL – Tiruchirappalli –
620014, India

Valves Engineering and R&D

PURCHASE SPECIFICATION

DOC No: **SPEC:CV:0013** Rev: 00

Effective Date: **11/02/2023**

Page: **9** of **11**

Product: Double Acting Pneumatic Actuators with Manual Override

27	Cylinder Material					
28	Cylinder Painting (or Plating)					
29	Piston Rod Diameter (mm)					
30	Piston Rod Material					
31	Seal Material					
Accessories Details						
	Item	Material	Size	Make / Model	Qty.	
32	Solenoid Valve, 5/2 way, 24V DC	SS316				
33	Equalizer Valve	SS316				
34	Silencer	SS316				
35	Check Valve (NRV)	SS316				
36	Ball Valve	SS316				
37	Flow Control Valve (FCV)	SS316				
38	Air Lock Relay (ALR)	SS316				
39	Air Filter Regulator (Double Acting) Auto Drain with Metallic Bowl	SS316				
40	Air Tube Fittings	SS316				
41	Limit Switch (IP-65, 24VDC / 230V AC)		2NO+2NC			
42	Cable (Solenoid valve to Junction Box)	3Cx1.5mm ² ; Unarmoured, HR PVC, FRLS, Mylar tape shielding				
43	Junction Box (JB)					
44	JB Material	Fibre Reinforced Plastic				
45	JB Protection Class (Assembled)	IP-55 (minimum)				
46	JB Terminals	Min. 24 terminals, 600V with lugs				
47	Cable Gland	7 Nos. Double Compression Brass Cable Gland				
		4 Nos. 4 Pair x 0.5 mm ² ; 3 Nos. 3C x 1.5 mm ²				
48	JB paint colour	RAL-7035				
Documents						
49	GA Drawing No.					
50	Pneumatic Circuit Diagram					
51	Electrical Circuit Diagram					
Remarks:						

Note: Vendor to provide the details in "Value" fields and/or furnish confirmation in "Yes/No" column. Any deviation must be exclusively mentioned.



365-147/B
31.08.16

BHEL – Tiruchirappalli –
620014, India

Valves Engineering and R&D

PURCHASE SPECIFICATION

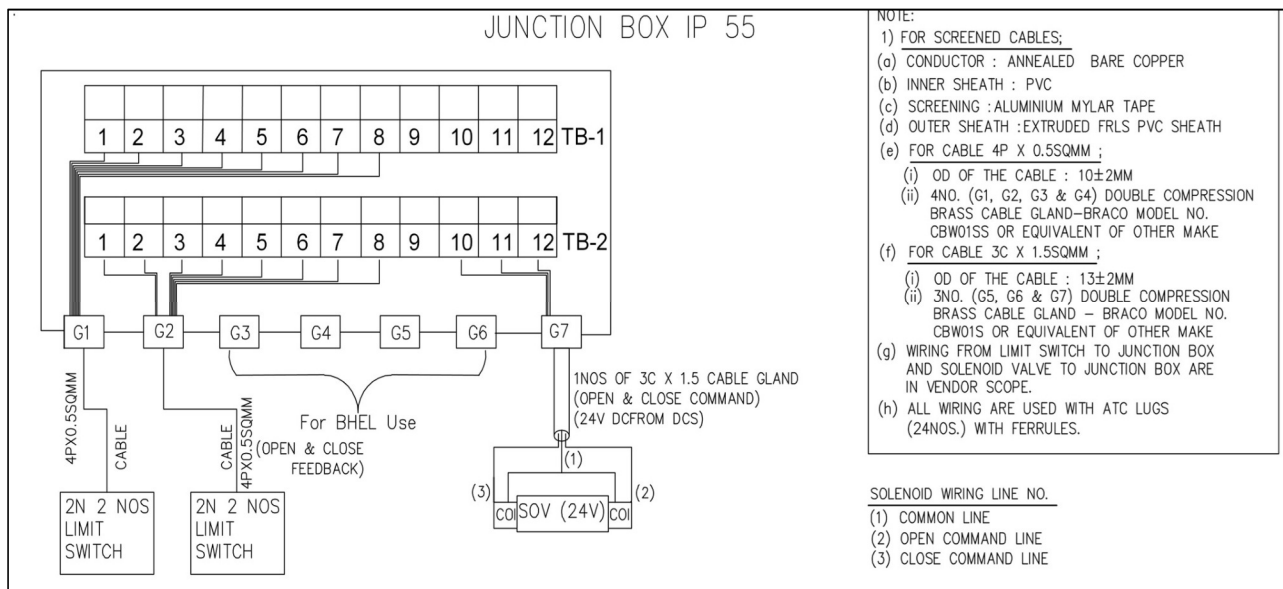
DOC No: **SPEC:CV:0013** Rev: 00

Effective Date: **11/02/2023**

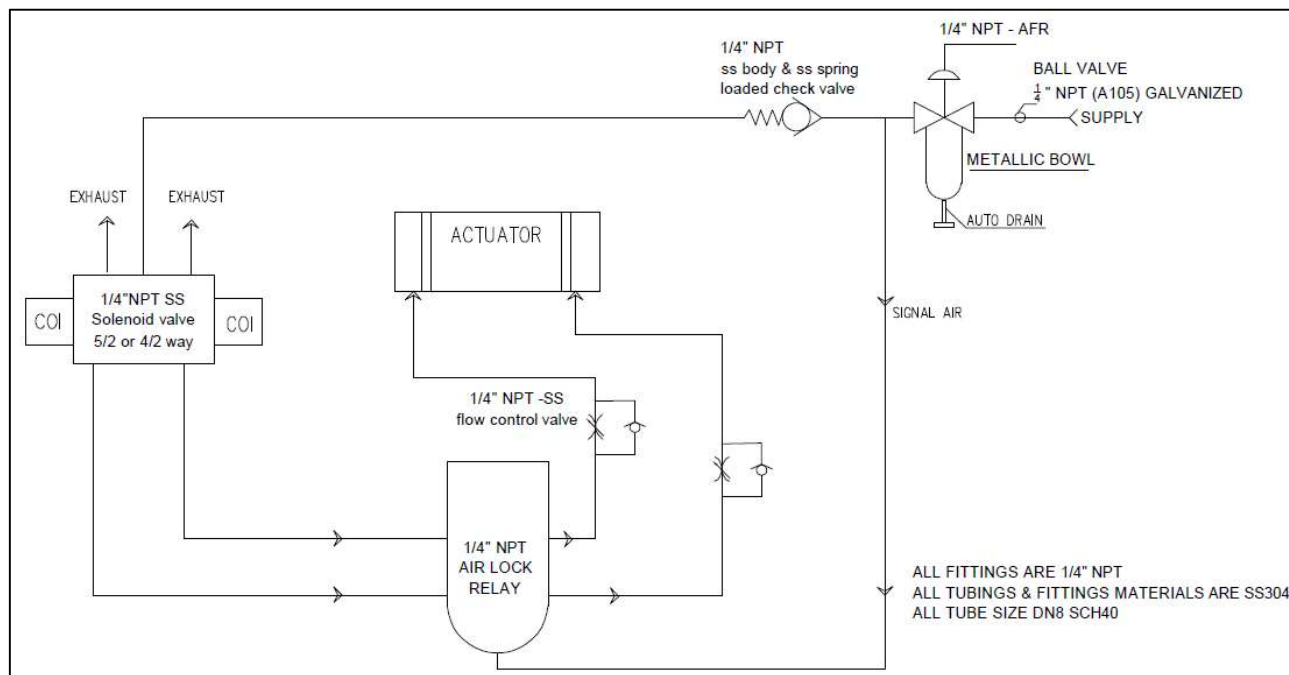
Page: **10** of **11**

Product: Double Acting Pneumatic Actuators with Manual Override

TYPICAL WIRING DIAGRAM



PNEUMATIC CIRCUIT DIAGRAM





365-147/B
31.08.16

BHEL – Tiruchirappalli –
620014, India

Valves Engineering and R&D

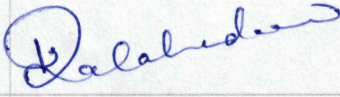
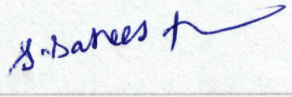
PURCHASE SPECIFICATION

DOC No: **SPEC:CV:0013** Rev: 00

Effective Date: **11/02/2023**

Page: **11** of **11**

Product: Double Acting Pneumatic Actuators with Manual Override

Signature			
Name	Mukesh Kumar	K Jalaludeen	S Sathees Kumar
Designation	Dy. Manager	Manager	Manager
Date	11 February 2023	11 February 2023	11 February 2023
Action	Prepared By	Checked & Reviewed By	Approved By

Product: Specification for Electrical Actuator

Revision Record:

Rev. No	Date	Details of Revision
04	01 January 2005	Specification updated for Rate contract
05	21 December 2005	High torque actuator requirement included
06	01 November 2013	Specification updated for Rate contract. Std. wiring diagrams added
07	20 August 2020	Specification format changed. Updated to take care Spring loaded type actuator.
08	27 May 2022	Packing procedure and Test requirements for Actuators, Cable Lugs requirement included.

IMPORTANT INSTRUCTIONS:

- Vendor shall furnish point-to-point confirmation / deviation to each clause of this specification explicitly.**
- The offer shall be submitted along with all the documents required in this specification. Offer without all supporting documents requested in this specification will not be considered.**

Clause. No	Specification requirement	Vendor confirmation / comments / deviation
G.0	GENERAL	
G.1.0	ENCLOSURE:	
G.1.1	Actuators shall be of totally enclosed weather proof and dust proof construction with min. IP 68 enclosure and shall be suitable for outdoor applications. The actuator should be capable of operating in ambient temperature of -20 deg.C to +70 deg.C.	
G.2.0	VOLTAGE:	
G.2.1	The unit shall be suitable for operation on a 415V, 3 phases, 50Hz. -3 wire system for actuator with integral starters. -4 wire system for actuator without integral starters.	
G.3.0	CONSTRUCTION:	
G.3.1	Actuators shall have provision to accommodate raising spindle of the valve and the hole shall be properly covered with a removable lid. The actuator shall be supplied with stem protection tube to accommodate larger spindle travel as indicated elsewhere in this specification. All the above parts, i.e. The threaded portion of actuator, removable lids and stem protection tubes shall be able to withstand the prolonged outdoor storage without getting rusted or damaged.	
G.3.2	The actuator shall be suitable for mounting directly on the valve. The actuator shall be capable of giving the required torque, rpm and thrust. The actuator shall be suitable for mounting in any position. Indicate the adjustable range of torque and starting torque of actuator in kgm/Nm for each actuator offered. The maximum thrust capability of the actuators shall also be furnished. The actuators shall be designed to take the full thrust. All Gears used shall be metallic. Fiber gears are not acceptable. Metallic gear trains used shall be self-locking to prevent drift under torque switch (wherever applicable) spring pressure when motor is de energised.	

Product: Specification for Electrical Actuator

Clause. No	Specification requirement	Vendor confirmation / comments / deviation
G.3.3	Actuator shall have thrust base with blank removable adaptor bush of aluminum bronze, which can be threaded to accommodate raising spindles of valve. NI-Resist material shall be supplied as optional if required.	
G.3.4	The exact mounting arrangement with dimensions shall be clearly furnished in the enclosed drawing. The flange dimension shall be as per DIN/ISO standard. For high torque actuator mounting dimensions shall be as per the BHEL approved dimensions.	
G.3.5	The dimension drawing of the blank adaptor bush shall be furnished in the enclosed drawing.	
G.3.6	Each actuator shall have a hand wheel fitted on it for manual operation in case of power failure. It shall be possible to fully open /close the valve with the hand wheel. The hand wheel shall be designed such that its engaging lever declutches automatically when the power supply to the motor is restored. The material of the hand wheel shall be either malleable iron or steel. The hand wheel-engaging lever shall give trouble free performance under repeated operations. Side mounted hand wheel with gear can be offered as optional. The hand wheel construction shall be strong enough to withstand the impacts of normal handling and storage of actuator without any damage. The hand wheel shall be able support the weight of the actuator, without any damage to actuator or hand wheel, when actuator is rested on the hand wheel.	
G.3.7	Actuators offered shall be with self-locking worm.	
G.3.8	Actuators shall have provision to set the Torque value from 40% of the maximum Torque mentioned in the below Table 1 .	
G.4.0	SPRING LOADED / THRUST COMPENSATOR ASSEMBLY OUTPUT DRIVE	
G.4.1	Spring loaded (or) thrust compensator drive assembly shall be provided wherever " AF " indicated in the actuator requirement Ref (Table 2). This drive assembly is required to take care of high dynamic thrust, which will be developed during multistage reduction process.	
G.5.0	REVOLUTIONS:	
G.5.1	Desired output shaft speeds are given below for different torque ranges. Actual speeds of actuators offered shall be clearly indicated.	
G.6.0	WEIGHT:	
G.6.1	Furnish weight of actuator including all accessories.	
G.7.0	LUBRICANT:	
G.7.1	Oil plugs shall be provided for filling and draining.	

Product: Specification for Electrical Actuator

Clause. No	Specification requirement	Vendor confirmation / comments / deviation
G.7.2	The gearbox of the actuator shall be oil filled or grease filled. The oil/grease must be suitable for operation for 80 Deg. above ambient temperature. Furnish detail of lubricant used with Indian oil Company's BPCL , IOCL & HPCL's equivalent. The actuator shall have proper seals to prevent leakage of oil at all installation positions. The actuator construction shall be such that the oil/grease does not leak to other compartments or outside. In case of any complaint of such leakage, the complaint shall be attended free of cost within one week and root cause of the problem shall be eliminated within one month.	

TABLE 1

Sl.no	Max.Torque (Kg-M)	RPM (Approx)	Output flange details in mm (LD x PCD x Bolt details)	Stem Protection Cover in mm
1	3	18	F10 (60 x 102 x 4Nos M10)*	100
2	6	24	F10 (60 x 102 x 4Nos M10)*	100
3	6	36	F10 (60 x 102 x 4Nos M10)*	150
4	15	36	F10 (60 x 102 x 4Nos M10)*	150
5	30	36	F14 (100 x 140 x 4Nos M16)*	250
6	30	96	F14 (100 x 140 x 4Nos M16)*	300
7	50	36	F16 (127 x 165 x 4Nos M20)*	300
8	60	96	F14 (100 x 140 x 4Nos M16)*	450
9	60	72	F14 (100 x 140 x 4Nos M16)*	450
10	80	36	F25 (152x254 x 8Nos M16)*	400
11	100	36	F25 (152x254 x 8Nos M16)*	500
12	100	96	F16 (130 x 165 x 4Nos M20)*	500
13	200	24	F25 (152x254 x 8Nos M16)*	500
14	300	24	F30 (177.8x298.5-8NOS M20)*	400
15	400	32	F30 (177.8x298.5-8NOS M20)*	400
16	800	22	F35 (215.9x355.6-8 NOS M24)*	450
17	1100	22	F40 (228.6x406.4-8 NOS M30)*	500
18	1600	22	F40 (228.6x406.4-8NOS M30)*	500

TABLE 2

Sl.No	Max.Torque (Kg-M)	RPM (Approx)	Out put flange details in mm (LD x PCD x Bolt Details.)	Stem Protection Cover in mm	Output drive type
1	15	36	F14 (100 x 140 x 4Nos M16)*	250	Spring loaded/ Thrust compensator assembly
2	25	36	F14 (100 x 140 x 4Nos M16)*	300	

***-Vendor has to adhere this BHEL's specific requirement**



365-147/B
31.08.16

**BHEL – Tiruchirappalli – 620014,
India**

Valves Engineering and R&D

PURCHASE SPECIFICATION

DOC No: **SPEC:AC:001** Rev: **08**

Effective Date: **23/ 06/ 2022**

Page: **4 of 19**

Product: Specification for Electrical Actuator

Clause. No	Specification requirement	Vendor confirmation / comments / deviation
G.8.0	DIMENSIONAL CATALOGUES (In English language)	
G.8.1	Three copies of catalogues of the actuators describing the constructional details, over all dimensions of the actuators, maximum spindle acceptance diameters and other details called for in the specification.	
G.9.0	O & M INSTRUCTION MANUALS: (In English language)	
G.9.1	O&M manual should have the procedure for safe disposal of items of failed actuator components along with O & M instruction. i) One Hard copy of Operating and Maintenance Instruction Manual along with wiring diagram shall accompany each actuator ordered. ii) One set soft copy O&M along with wiring diagram should be submitted before actuator dispatch.	
A.0	ACCESSORIES	
A.1.0	TORQUE SWITCHES:	
A.1.1	Two numbers adjustable torque switches (one for open and one for close) each with 2 NO and 2 NC potential free contacts. The type of torque switch like rotary/cam shall be mentioned in the data sheet.	
A.1.2	The torque switches shall have accuracy of plus or minus 5% of set value.	
A.1.3	A scale shall be provided for each torque switch to set required torque. Each division shall indicate actual value of torque. The scale-setting knob shall have locking screw to avoid any setting disturbance at site due to line vibration.	
A.1.4	Actuators shall have provision for bypassing the torque switch during initial 5% opening of valves. Details for this must be indicated in the wiring diagram.	
A.1.5	The wiring diagram shall include details of changes to be done for making the actuator suitable for torque seating or position seating valves.	
A.2.0	LIMIT SWITCHES:	
A.2.1	Two numbers of position limit switches (one for open and one for close) each with 2 NO and 2 NC potential free contacts. The type of limit switch like rotary/drum/cam type shall be mentioned in the data sheet.	
A.2.2	Two Auxiliary limit switches (one for open and one for close) each with 2 NO and 2 NC potential free contacts.	
A.2.3	Each limit switch shall be capable of being set to trip at any position independently between fully open and fully closed position.	
A.2.4	Limit switches and torque switches shall be weather proof suitable for damp atmospheres, and shall not cause any trouble during commissioning and operation. Further the operating mechanism of the switches (like shafts, gears, cams, metallic parts etc) shall be able with stand exposure to damp atmosphere for long time without getting rusting or damaged. If any such damage is reported it shall be attended free of cost within one week and root cause of the problem shall be eliminated within one month.	
A.2.5	The torque and position limit switches shall be suitable for the following ratings, both 240 volts, AC, 5 amps and 220 volts DC, 0.5 amps. The insulation level between each set of contacts shall be minimum of 1.2KV for 1min.	



365-147/B
31.08.16

**BHEL – Tiruchirappalli – 620014,
India**

Valves Engineering and R&D

PURCHASE SPECIFICATION

DOC No: **SPEC:AC:001** Rev: **08**

Effective Date: **23/ 06/ 2022**

Page: **5 of 19**

Product: Specification for Electrical Actuator

Clause. No	Specification requirement	Vendor confirmation / comments / deviation
A.3.0	LOCAL POSITION INDICATORS:	
A.3.1	Each actuator shall have a local position indicator to indicate 0 to 100% of valve travel.	
A.3.2	The actuator shall be suitable for operating different valve size with varying lifts. The actuators shall have adjustable gear for the local position indicator so that accurate indication of valve position can be obtained for all valve lifts by adjusting the gears. The gears selection chart for setting of local position indicator and mechanical transmitter for different valve lifts (output shaft revolutions) shall be furnished. Also one set of change gears shall be supplied along with each actuator, alternately the change gears/spacers shall be supplied in sufficient quantities whenever required.	
A.4.0	ANTI-CONDENSATION HEATER (SPACE HEATER):	
A.4.1	Each actuator shall have an anti-condensation heater in the limit switch compartment. In case of integral starter actuator, the space heater supply shall be derived internally, if integral starter is not available it shall be suitable for 240V AC 50 Hz single phase supply. The wattage of the heater shall be specified in the data sheet and wiring diagram.	
A.5.0	REMOTE POSITION TRANSMITTER:	
A.5.1	Open/Close actuator shall have two Nos. of resistance type position transmitter for remote indication. Rating of position transmitter 100ohms, 50 Volts, AC/DC. A suitable fixed dropping resistor must be put in series for limiting the power consumption.	
A.5.2	For regulating and inching duty applications, actuators shall have one electronic position transmitter (EPT), suitable for 24V DC with an output of 4-20mA and 2 wire. LVDT type transmitter shall be supplied wherever indicated.	
M.0	MOTORS	
M.1.0	POWER SUPPLY:	
M.1.1	Motor shall be suitable for operation on a 415V, 3 phase, 3 wire ungrounded supply system.	
M.1.2	Motor shall operate without any trouble under the following conditions. a. If the voltage varies within plus or minus 10% of the rated value of 415 Volts. b. If the frequency of the power source varies within plus or minus 5% of 50 Hz. c. If the voltage and frequency of the source vary simultaneously and the sum of the absolute percentage values in variation does not exceed 10%.	
M.2.0	CONSTRUCTION:	
M.2.1	Motor shall be totally enclosed with min IP68 weatherproof enclosure and shall be suitable for outdoor installation without canopy. In case of any water leakage due to enclosure failure it shall be attended free of cost within one week and root cause of the problem shall be eliminated within one month.	
M.2.2	Motor shall be conforming to BS 2613-70, IS 325 or any other equivalent international standard for all requirements unless otherwise specified herein.	

Product: Specification for Electrical Actuator

Clause. No	Specification requirement	Vendor confirmation / comments / deviation
M.2.3	Motor shall be painted with corrosion proof & weather proof paint. Painting colour scheme shall be as per BHEL's requirement, which will be informed after placement of order.	
M.3.0	INSULATION:	
M.3.1	Motor shall have class F non-hygroscopic insulation with tropicalisation suitable for polluted dusty and corrosion atmospheres of relative humidity 100%. Motor shall be designed for the design ambient temp. However, the temperature rise of the motor winding shall be limited to the maximum temperature allowed for class 'B' insulation. It shall also be possible to rewind the motor in case the windings and insulation get burnt out.	
M.4.0	RATING:	
M.4.1	Motors shall be S2-15 min. rating. This shall not be less than the highest of the following: 1) Fifteen minutes. 2) As required for three successive open/close operations. 3) As required for the service. The motor shall be suitable for min 60 starts/hr. for on/off and 150 starts/hr. for inching duty application. 600 and 1200 starts/hour shall be given as optional.	
M.5.0	STARTING:	
M.5.1	Motor shall be suitable for direct on-line starting.	
M.5.2	Starting current shall be limited to 6 times the full load current.	
M.5.3	Motor shall be capable of 1. Starting at 85% of rated voltage. 2. Running at 80% of rated voltage for a period of 5 minutes, at 1/3 load. 3. The torque at reduced supply voltage shall be mentioned for 75% voltage, 80% voltage, 85% voltage & 90% voltage.	
M.6.0	BEARINGS:	
M.6.1	Bearing shall be of double shielded, grease lubricated antifriction type. The anticipated bearing life shall be indicated for all models.	
M.7.0	EARTHING TERMINALS:	
M.7.1	Two earthing terminals shall be provided on either side of the motor.	
M.8.0	MOTORS:	
M.8.1	Motors shall be provided with three numbers of Thermostats, one in each winding, for over load protection.	
M.9.0	MOTOR DATA:	
M.9.1	One set of hard and soft copies of motor data sheets for each type of actuators ordered shall be furnished as per format furnished.	
M.10.0	WEIGHT	
M.10.1	Weight of the actuator with and without starter shall be furnished separately along with the offer.	
M.11.0	TESTS:	
M.11.1	Tests shall be carried out as per approved QP.	



365-147/B
31.08.16

**BHEL – Tiruchirappalli – 620014,
India**

Valves Engineering and R&D

PURCHASE SPECIFICATION

DOC No: **SPEC:AC:001** Rev: **08**

Effective Date: **23/ 06/ 2022**

Page: **7 of 19**

Product: Specification for Electrical Actuator

Clause. No	Specification requirement	Vendor confirmation / comments / deviation
C.0	CONTROLS	
C.1.0	INTERNAL WIRING:	
C.1.1	Internal wiring diagram shall be neatly pasted on cover of terminal box.	
C.1.2	Internal wiring shall be done with 1.5 sq.mm PVC insulated copper wires. Ferrules should be provided on both ends of the wire for easy identification.	
C.2.0	FEATURES APPLICABLE TO INTEGRAL STARTER	
C.2.1	Control supply shall be derived with step down transformer from 415V, 3 PH, 50Hz incoming supply (For AC actuator only). Necessary primary and secondary fuses shall be provided. All the PCBs shall be protected against moisture by suitable coating and treatment - in case of failure of PCBs due to moisture entry it shall be attended free of cost within one week and root cause of the problem shall be eliminated within one month.	
C.2.2	Automatic phase correction facility and single phasing prevention shall be available.	
C.2.3	Pad lockable Selector switch for LOCAL-OFF-REMOTE selection with OPEN-STOP-CLOSE push buttons (for local operation) shall be provided.	
C.2.4	It should also be possible to reverse the direction of travel for inching valves (in LOCAL and REMOTE) without giving stop command.	
C.2.5	In addition to mechanical dial position indicator, lamp indication for full open, full close and in-travel positions shall be provided.	
C.2.6	Electrically and mechanically interlocked contactors shall be provided for forward and reverse operation. Contactor rating shall be sufficient to withstand the extreme conditions like valve jamming and instantaneous reversal of motor.	
C.2.7	Potential free contacts for LOCAL-OFF-REMOTE positions shall be wired to terminals and available for customer connections.	
C.2.8	Open/Close command termination logic with position and torque limit switches shall be suitably built in the PCB inside the actuator.	
C.2.9	The selection of the following mode shall be available locally on actuator through suitable switch programming. It shall also be clearly described in wiring diagram. a) Valve seating by torque switch (close) or limit switch (close) shall be available. b) Inching (non self-retaining) or non-inching (self-retaining) for remote command and local mode shall be field configurable.	
C.2.10	Provision shall be there for bypassing the torque switch during initial 5% opening and closing of valves. Details for this must be indicated in the wiring diagram. This shall be done through electronic circuit or through one 'NC' contact of 'limit switch'.	
C.2.11	A minimum of '1NO+1NC' contact of Main limit switches and torque switches shall be available for customer use. All the contacts of aux. Limit switches shall also be available for customer use.	



365-147/B
31.08.16

**BHEL – Tiruchirappalli – 620014,
India**

Valves Engineering and R&D

PURCHASE SPECIFICATION

DOC No: **SPEC:AC:001** Rev: **08**

Effective Date: **23/ 06/ 2022**

Page: **8 of 19**

Product: Specification for Electrical Actuator

Clause. No	Specification requirement	Vendor confirmation / comments / deviation
C.2.12	Actuator shall be suitable for remote operation by potential free contacts for open / close and stop, the necessary 24V DC power supply shall be derived internally. Also It shall be possible to energize the interposing relays provided (with coil burden $\leq 2.5\text{VA}$, one for open and one for close) to initiate opening and closing by 24V DC signal from the external control system.	
C.2.13	24V Power supply for EPT shall be derived internally.	
C.2.14	Thermal overload relay shall be provided in addition to thermostats embedded in motor winding. Overload relay and thermostats shall be connected in control circuit to trip actuator in case of overload. OLR set value shall be mentioned in wiring diagram / Data sheets .	
C.2.15	A common potential free contact (monitoring relay) shall be available to annunciate the following faults. a) Thermostat trip b) OLR trip c) Valve jammed in mid-travel. d) Motor single phasing. e) Power failure. f) Local stop or local/remote selector switch in local mode.	
C.2.16	The following status annunciation shall be made available locally (integral to actuator) a) Actuator running in OPEN b) Actuator running in CLOSE c) Internal 24V DC Control voltage healthy d) 24V DC availability for customers use healthy.	
C.2.17	The following individual fault annunciation shall be made available locally (integral to Actuator) for easy trouble shooting a) Torque switch OPEN b) Torque switch CLOSE c) Thermostat trip d) Thermal overload relay trip e) Motor single phasing	
C.2.18	BLINKER RELAY: Blinker relay contact for remote indication of 'actuator running' is to be provided as a standard part of integral starter actuator.	
C.3.0	TERMINAL BOX:	
C.3.1	All terminals of position limit switches, torque limit switches, space heaters and position transmitters shall be brought to a common terminal board. The terminals shall be clip-on type/screw type with sufficient insulation between 2 adjacent terminals. All terminals must be suitable for 2 nos. of 2.5 sq.mm wires. All the Actuators are to be provided with one set of copper lugs ring type (03 nos) in terminal box with suitable power rating and cable size for power cable termination at actuator end Power cable size is given below Ref (Table 03).	

Product: Specification for Electrical Actuator

C.3.2	Minimum 10 numbers of terminals shall be available in the terminal board as spare terminals.	
Clause. No	Specification requirement	Vendor confirmation / comments / deviation
C.3.3	Terminal box of actuator shall be weather proof and have enough space for connecting three numbers of PVC insulated unarmoured copper conductor control cable 19-pair / 1.5 sq.mm. One Number PVC insulated unarmoured copper / aluminium conductor power cable with sizes as indicated in clause C.3.1. Motor terminals shall be of stud type, screw type and press fit type depending on the power rating. Terminal box shall be fitted with a removable front cover plate.	
C.3.4	DEFAULT SETTING OF TORQUE SWITCH, DIAL INDICATOR ON AND TORQUE/LIMIT CLOSING. The requirement of the default setting of torque switch, dial indicator and torque closing/limit closing selections are already provided by BHEL for all models. The same has to be followed. The list of default setting to be included in the documents.	
C.4.0	CABLE GLAND:	
C.4.1	Actuators are to be provided as a standard with one cable gland for power and minimum 3 cable gland for control (or) two plug & sockets for control to be provided (In case of flameproof actuator 3 cable glands for control to be provided). The cable gland details along with the cable OD that can be accommodated is indicated below. If any other cable size is envisaged this will be informed during order stage. However for actuators with plug and socket, minimum necessary cable glands shall be provided. All the cable glands shall be of double compression type. Power cable size is given below. The cable entries shall be closed with metallic gland plug with suitable sealing (like 'o' ring) to ensure IP68 protection.	
C.4.2	Preferably all the cable glands shall be provided on one direction (face) only. Wherever this is not technically feasible, the cable gland on the second side shall be provided with necessary elbows, so that all glands will be facing at one side.	

TABLE 3

KW	DESC	OD
UPTO 3 KW	3 Core x 2.5Sq.mm Copper unarmored PVC insulated	14±2mm
Above 3 to 7 KW	3 Core x 6Sq.mm Aluminum unarmored PVC insulated	17±2mm
Above 7 to 13 KW	3 Core x 16Sq.mm Aluminum unarmored PVC insulated	20±2mm
Above 13 to 24 KW	3 Core x 35Sq.mm Aluminum unarmored PVC insulated	25±2mm
Above 24 to 37 KW	3 Core x 70Sq.mm Aluminum unarmored PVC insulated	31±2mm

Product: Specification for Electrical Actuator

Clause No	Specification requirement	Vendor confirmation / comments / deviation
C.5.0	FEATURES APPLICABLE TO FLAME PROOF ACTUATORS	
C.5.1	STANDARDS	
C.5.1.1	Actuators meant for hazardous area shall meet the requirements of latest IS 2148/IEC60079, IEC – 79 or equivalent International Standards.	
C.5.1.2	Indigenous equipment shall be certified by CIMFR and approved by PESO and DGFASLI and shall carry the BIS License Marking. All the certification shall be valid at the time of delivery.	
C.5.1.3	Imported equipment shall be tested and certified by an independent certifying agency of country of equipment origin.	
C.5.2	ENVIRONMENT:	
C.5.2.1	Area Classification: Class 1, Division 1, Zone 1	
C.5.2.2	Gas Group: IIA & IIB. - IIC if specified	
C.5.2.3	Temperature Class (As per IEC-79): T3 (200 Deg. C) T4 if specified	
C.5.2.4	Construction: Flame Proof Ex (d) as per IS 2148/IEC60079	
C.5.3	CABLE GLANDS: Flame proof, double compression Nickel plated brass cable glands shall be provided for conduit entries. Unused entries shall be plugged with flame proof plugs.	
D.0	DOCUMENTATION REQUIREMENTS	
D.1.0	The following documents are to be furnished along with offer and after ordering	
	a. GA drawings for all models including dismantling clearances.	
	b. The dimension drawing of the blank adopter bush	
	c. Data sheet for all models. Along with weight of the actuator	
	d. Dimensional catalogue with maximum spindle acceptance details	
	e. Wiring diagram for all models.	
	f. Gear selection chart for setting of local position indicator	
	g. Outline dimension of assembled motor.	
	h. Outline dimension of actuator.	
	i. Dimensional drawing of terminal showing the method of terminating incoming cables.	
	j. CIMFR Test Certificates for Flame proof Actuator	
	k. Approvals of PESO and DGFASLI for Flame proof Actuator	
	l. BIS License for Flame proof Actuator	
	m. General arrangement drawing of actuator consisting following as minimum.	



365-147/B
31.08.16

**BHEL – Tiruchirappalli – 620014,
India**

Valves Engineering and R&D

PURCHASE SPECIFICATION

DOC No: **SPEC:AC:001** Rev: **08**

Effective Date: **23/ 06/ 2022**

Page: **11** of **19**

Product: Specification for Electrical Actuator

Clause. No	Specification requirement	Vendor confirmation / comments / deviation
	i) Identification of critical component with its material composition.	
	ii) Mounting flange dimension	
	iii) Hand wheel dimensions	
	iv) Actuator cover removal clearances	
	v) Weight of actuator with and without integral starter	
	vi) Stem protection cover length, thread size and type	
	vii) Double compression cable gland	
	viii) Separate drawing for details of cable gland cross section, min/ max.	
	ix) Cable OD that can be accommodated, critical dimension etc.	
	n. Quality plan.	
	o. Type test certificates	
	p. Default settings of torque, dial indicator and torque/limit closing for all models.	
Q.0	QUALITY REQUIREMENTS	
Q.1.0	INSPECTION AND TEST REQUIREMENTS	
Q.1.1	All equipment's shall be subject to inspection by BHEL/ Client and/or their nominated inspecting authority. Vendor shall make all provisions in his shop/sub-vendors shops for complete inspection and test of actuator as per BHEL approved vendor's QP.	
Q.2.0	TESTS& INSPECTION:	
Q.2.1	During fabrication/testing, the actuator shall be subject to inspection by BHEL/CUTOMER or by any agency authorized by them. Manufacturer shall furnish all necessary information concerning the supply to BHEL/CUTOMER inspectors.	
Q.2.2	All routine tests as specified by the applicable standards shall be conducted.	
Q.2.3	Shop tests shall be witnessed by an inspector of BHEL/CUTOMER or of an agency authorized by customer.	
Q.2.4	Quality plan for the actuator to be followed.	
Q.3.0	PAINTING,PROTECTION,PACKING,SUPPLY & IDENTIFICATION:	
Q.3.1	SURFACE PREPARATION: Weld slag & spatter shall be removed and the surfaces to be coated shall be free from contamination. Surface defects shall be removed by suitable methods. Sharp edges shall be smoothened by grinding. Prior to surface preparation oil, grease, drilling emulsions, cutting emulsions and preservative agents shall be carefully removed by suitable solvents. The surface shall be carefully dried with clean clothes to prevent the dissolved impurities from spreading over the entire surface. The surface shall be cleaned by wire brush and shot blasting if required. Proper adhesiveness of paint to the surface shall be ensured.	

Product: Specification for Electrical Actuator

Clause. No	Specification requirement	Vendor confirmation / comments / deviation
Q.4.0	PAINT SHADE	
Q.4.1	The enclosures shall be treated and prepared for painting with suitable painting system for withstanding 500Hrs of salt spray as per ASTM B-117/ ISO9227 standard. Paint shade shall 'shade 692 of IS 5 (Smoke Grey)'. For NTPC projects the paint shade shall be as per the NTPC approved shade.	
Q.5.0	PACKING & TRANSPORT:	
Q.5.1	The actuator shall be supplied to site packed in wooden crates / Carton boxes. They shall be wrapped with polythene sheets. They shall have skid bottoms for handling. All spares shall be packed separately in boxes marked SPARE Special precaution notations such as Fragile. This side up, centre of gravity, weight, Owner's particulars. Purchase number etc. shall be clearly marked on the package together with other details as per purchase order. The equipment may be stored in a covered shed for long periods before installation. The packing should be suitable for such storage.	
S.0	SPARES	
S.0.1	Supplier shall specify a list of recommended spares for 2/5 years trouble free operation. An exploded view of the actuator shall be furnished with part numbers for identifying the spares.	
T.0	TEST REQUIREMENTS FOR ACTUATORS	
T.1.0	ROUTINE TEST:	
T.1.1	Dimensions: Overall and mounting	
T.1.2	Details of painting as per specification and vendor practice: Anti-corrosiveness Epoxy.	
	i. Shade.	
	ii. Finish	
	iii. Paint thickness	
T.1.3	Manual operation through hand wheel.	
T.1.4	Testing of position and torque limit switches for accuracy and repeatability.	
T.1.5	Hand-Auto switching function.	
T.1.6	For motors, all routine tests as called in IS: 325 / BS 4999 from motor manufacturer.	
T.1.7	Output shaft speed and torque of actuator and corresponding current.	
T.1.8	Stall current and stall torque for the actuator assembly.	
T.1.9	a. Position indicator and transmitter: Calibration check for accuracy, linearity and repeatability.	
	b. Functional test for electronic position transmitter.	
T.1.10	Leakage test for gear case (visual).	
T.1.11	HV test at 1.6 KV (80% of 2 KV) for the assembled actuator.	
T.1.12	Operation of actuator under variation in supply voltage (plus or minus 10%) for verifying rated torque and speed.	

Product: Specification for Electrical Actuator

Clause. No	Specification requirement	Vendor confirmation / comments / deviation
T.1.13	Checking of wiring as per approved wiring diagram (Typical WD for actuators without starters is attached).	
T.1.14	The following tests are applicable for integral starter actuators a. Functional test for local / remote / off selection b. Open/close/stop operation in local and remote mode. c. OLR tripping d. Functional test, temperature cyclic test and Screening and burning Test & HV test on PCB (Ref standard BS 4584 & BS 6221). The vendor shall arrange all testing facilities 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 etc., at vendor cost. Test certificates for routine type tests are to be furnished by the vendor.	
T.2.0	TYPE TEST certificates shall be provided for the following tests.	
T.2.1	Type test for motor as per IS:325/BS 4999 part 60.	
T.2.2	Noise and vibration test for total assembly IS: 4729/BS 4999.	
T.2.3	Temperature rise test during: a. Operation of actuator at 90% voltage. b. Operation of actuator at 50 degree C ambient.	
T.2.4	Operation with variation in frequency (plus or minus 5%) for verifying rated torque and speed.	
T.2.5	Enclosure protection for the total assembly.	
T.2.6	Endurance test for actuator.	
T.2.7	Endurance test for limit switches.	
T.2.8	Damp heat cycle test as per IS:9000/IEC 68-30.	
T.2.9	Following test are applicable for integral starter actuators a. Type test on bare PCB b. Life cycle test C. Dry heat test, D Temperature rise test for PCB (Ref standard BS 4584 & BS 6221)	
N.0	NOTES:	
N.0.1	These quality plans shall be approved by BHEL.	
N.0.2	All testing facilities shall be arranged by the vendor, at his works before calling BHEL representative for inspection.	
N.0.3	Approved drgs., PO specification and relevant standards if any shall be made available during testing / inspection.	
N.0.4	All measuring and testing instruments shall be periodically calibrated from National test house and certificates made available during inspection.	
N.0.5	All relevant GA drawings, data sheets & wiring diagrams shall be submitted as controlled copy and approval shall be obtained from BHEL. All supply shall be as per these documents.	

Applicable terminal plans for actuator with integral starter (3-V-MISC-24227),

Actuator without integral starter ((4-V-MISC-90271) and

For NTPC projects integral starter with Plug Socket (3-V-MISC-24283) enclosed



365-147/B
31.08.16

BHEL – Tiruchirappalli – 620014,
India

Valves Engineering and R&D

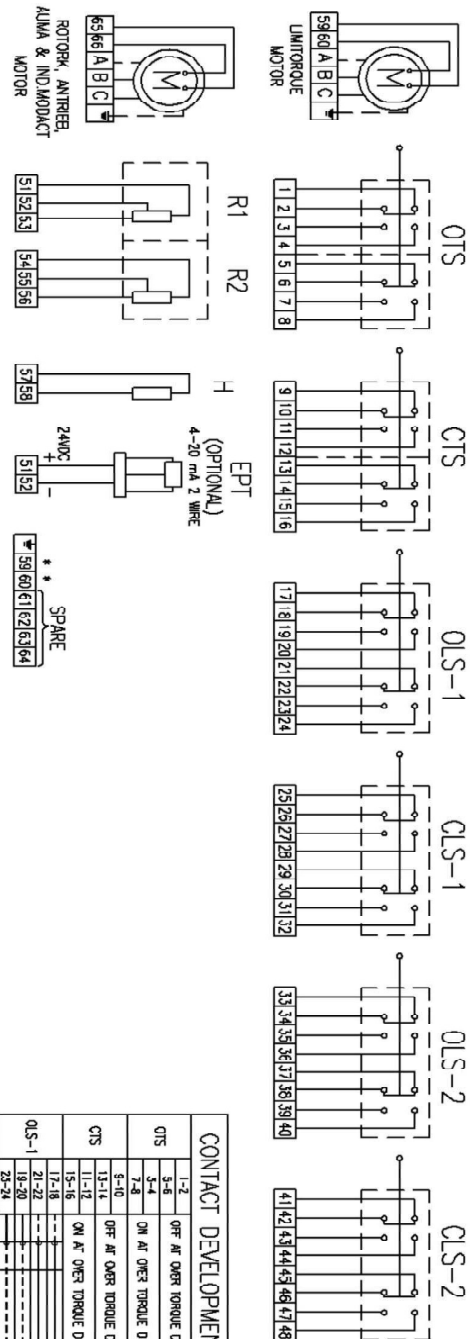
PURCHASE SPECIFICATION

DOC No: **SPEC:AC:001** Rev: **08**

Effective Date: **23/ 06/ 2022**

Page: **15 of 19**

Product: Specification for Electrical Actuator



* - SPARE FOR ROTOR, AUMA, ANTIREB & INDUOACT
SWITCHES - ALL ARE POTENTIAL FREE AND TWO PAIR OF CONTACTS CAN BE USED FOR DIFFERENT SUPPLY
THERMOSTAT - 65-66 (ROTOR, AUMA, ANTIREB & INDUOACT) 59-60 (LIMITROQUE)
EPT - ELECTRONIC POSITION TRANSMITTER (POTENTIOMETRIC TYPE, FOR INCHING DUTY)
THERMOSTAT TERMINALS - TERMINATED IN MOTOR TB IN ANTIREB & INDUOACT AND IN MAIN TB IN OTHER MAKES
CTS - TORQUE SWITCHES FOR CW ROTATION (CLOSE) - 2 NC+2 NC
OTS - TORQUE SWITCHES FOR CCW ROTATION (OPEN) - 2 NC+2 NC
OLS-1, OLS-2 - LIMITSWITCHES FOR POSITION OPEN - 2 NO-2 NC
OLS-1, OLS-2 - LIMITSWITCHES FOR POSITION CLOSE - 2 NO-2 NC
OTS, CTS - TWO INDEPENDENT SWITCHES IN ANTIREB & LIMITROQUE
OLS-2 & OLS-2 - CAM DISC IN ROTOR & ANTIREB
R1-R2- POTENTIOMETER 2 K 100 OHMS
H - SPACE HEATER 14 240V AC SUPPLY
M - MOTOR 3A 415V 50 Hz AC SUPPLY

NOTE
1. BYPASS OTS FOR INITIAL 5% OF TRAVEL (FOR GATE VALVES ONLY)
2. CONNECT THERMOSTAT WITHOUT FAIL IN THE STARTER CIRCUIT

CONTACT RATING: 5A AT 250V AC & 0.5A AT 220V DC

VALUES	OPEN		CLOSE	
	MAIN	BACK UP	MAIN	BACK UP
GATE VALVE OF 100 mm AND ABOVE IN 1500 CL AND ABOVE RAINING	OTS	OTS	OTS	CTS
ALL OTHER GATE & GLOBE VALVES	OTS	OTS	CTS	CTS

● - OLS NOT TO BE CONNECTED IN TRIP CIRCUIT

CONTACT DEVELOPMENT DIAGRAM									
CONTACT	1-2	3-6	5-6	7-8	9-10	11-12	13-14	15-16	17-18
CTS	OFF AT OPEN TORQUE DURING OPENING TRAVEL	ON AT OPEN TORQUE DURING OPENING TRAVEL	ON AT OPEN TORQUE DURING OPENING TRAVEL	OFF AT OPEN TORQUE DURING CLOSING TRAVEL	ON AT OPEN TORQUE DURING CLOSING TRAVEL	ON AT OPEN TORQUE DURING CLOSING TRAVEL	ON AT OPEN TORQUE DURING CLOSING TRAVEL	ON AT OPEN TORQUE DURING CLOSING TRAVEL	ON AT OPEN TORQUE DURING CLOSING TRAVEL
OTS	1-12	13-14	15-16	17-18	19-20	21-22	23-24	25-26	27-28
OLS-1	29-30	31-32	33-34	35-36	37-38	39-40	41-42	43-44	45-46
OLS-2	47-48	49-50	51-52	53-54	55-56	57-58	59-60	61-62	63-64
OLS-3	65-66	67-68	69-70	71-72	73-74	75-76	77-78	79-80	81-82
SPARE	83-84	85-86	87-88	89-90	91-92	93-94	95-96	97-98	99-100

INDICATES CONTACT CLOSED
INDICATES CONTACT OPEN

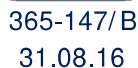
REV	DATE	CHD	APPD	DESCRIPTION	DRAWING NO.	REV
11	09.09.2000			CONTACT REV. (C.A. 00000)	4-V-MISC-90271	11
10	09.09.2000					
9	09.09.2000					
8	09.09.2000					
7	09.09.2000					
6	09.09.2000					
5	09.09.2000					
4	09.09.2000					
3	09.09.2000					
2	09.09.2000					
1	09.09.2000					

RETRACTED WITH REVISION 11

BHARAT HEAVY ELECTRICALS LTD.
UNIT HIGH PRESSURE BOLDS PLANT,
TIRUCHIRAPPALLI 620014.

INTERNAL WIRING DIAGRAM
FOR
ELECTRICAL VALVE ACTUATORS (AC)
(ORIGIN FOR INTERMEDIATE POSITION OF VALVES)

365-139
NIPESBAR
KARUNAGAPURAM
CHECKED
P. LOKANATHAN
APPROVED
DATE: 09.09.2000

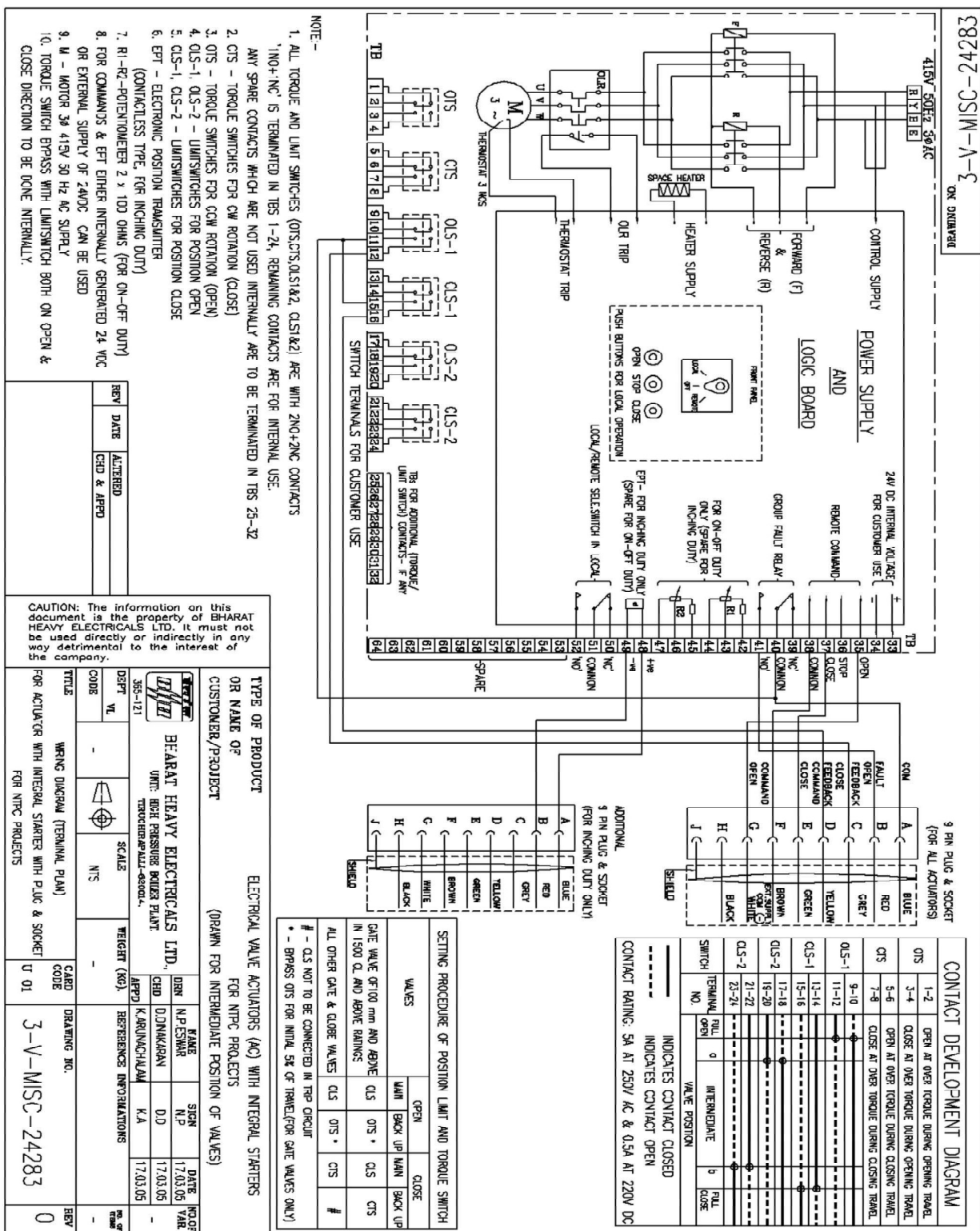


Valves Engineering and R&D

PURCHASE SPECIFICATION

Page: 16 of 19

Product: Specification for Electrical Actuator



Size A3

Product: Specification for Electrical Actuator

ANNEXURE-A : Instruction for packing of Actuator/ Bevel Gearboxes

Packing box :

- 1.1) The Actuator/Gearbox shall be supplied packed in any seasoned wood or plywood as wooden box as per relevant international standard. Sea worthy packing is envisaged for international shipments.
- 1.2) The box shall have inner lining of polythene sheet (minimum of 250G polythene sheet)/waxed paper/water proof paper or similar protection against water entry.
- 1.3) Use fillers like thermocol / loose fill or air-cellular cushioning material such as Bubble Wrap to fill void spaces and prevent movement inside the box during shipping.

Actuator/Gearbox Covering:

- 1.4) Further the Actuator/Gearbox shall be completely covered with a water-proof barrier highly resistance to the passage of water-vapour - like thick polythene bag (Minimum of 500G thickness). Sharp corners, edges and projects of the Actuator/Gearbox should be covered to prevent abrasion or puncture of the water proof barrier with anti-abrasive material like felt. Extra length and projections of the polythene bags are to be wrapped and secured by strips of self-adhesive tapes.
- 1.5) After opening the box, the water-proof barrier shall be intact and it is intended to store Actuator/Gearbox for long time with this water-proof barrier.
- 1.6) Suitable desiccants shall be provided in to the sealed water proof barrier. The desiccant shall be in small bags and disposed uniformly. They shall be secured in position to minimize chances of desiccant dust escaping. The amount of total desiccant shall be such to limit the relative humidity within the cover to a maximum value of 50 percent – for a long time of storage.
- 1.7) The equipment's covered with a polythene sheet shall be kept inside the box, followed by coir, wooden bottoms, loose fill or air-cellular cushioning material such as Bubble Wrap to fill void spaces, thermocol, etc. to prevent vibration effect during loading, transportation, etc.
- 1.8) On all sides of the inner case, black polythene sheet shall be nailed.
- 1.9) Loose items of the equipment if any shall be packed separately.

Marking on the box:

- 2.1) All spares shall be packed separately in boxes marked SPARE. Spare components are also to be covered separately with water-proof packing.
- 2.2) Actuator/Gearbox model and material code shall be prominently marked on the box.
- 2.3) Special precaution notations such as 'Fragile', 'This side up', 'center of gravity', 'weight', 'Owner's particulars', 'Purchase Order No.', 'Order item No.' etc. shall be clearly marked on the package together with other details as per purchase order.
- 2.4) After completing the packing, Stencil marking, as per dispatch instructions and symbol marking as per **Annexure — 1** shall be made.

Packing slip

A copy of the packing slip, kept in a polythene cover shall be kept inside the box. Another copy of the packing slip, kept in a polythene cover shall be kept out side the box and covered with a metallic plate to the case. ..



365-147/B
31.08.16

BHEL – Tiruchirappalli – 620014,
India

Valves Engineering and R&D

PURCHASE SPECIFICATION

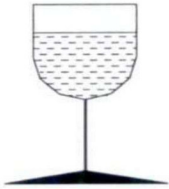
DOC No: **SPEC:AC:001** Rev: **08**

Effective Date: **23/ 06/ 2022**

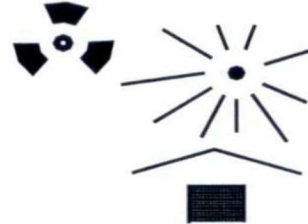
Page: **18 of 19**

Product: Specification for Electrical Actuator

ANNEXURE — 1



FRAGILE, HANDLE WITH CARE



PROTECT FROM HEAT AND RADIOACTIVE
SOURCES



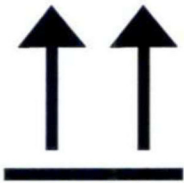
USE NO HOOKS

NOTE: The design of heavy goods packages
cannot always resist top lifting by
grabhooks.



KEEP DRY

NOTE: Not all cases have waterproof internal liners;
plywood used in the construction may not have
a waterproof glue line.



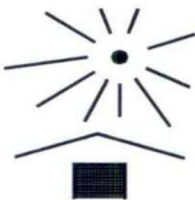
THIS WAY UP

NOTE: Certain designs of small cases
make it difficult to distinguish
top from bottom.



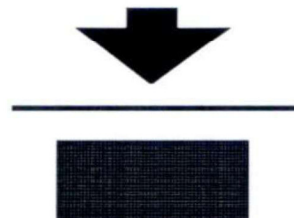
CENTRE OF GRAVITY

NOTE: This should be stencilled as a minimum on the
two longest case sides (this information
will normally be supplied by the manufacturer
of the item(s) packed).



KEEP AWAY FROM HEAT

... kg max



STACKING LIMITATION

NOTE: The maximum load in kilograms should be marked
above the arrow.



INTERNATIONAL "SLING HERE" SYMBOL



365-147/B
31.08.16

BHEL – Tiruchirappalli – 620014,
India

Valves Engineering and R&D

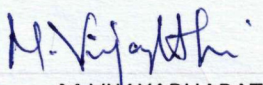
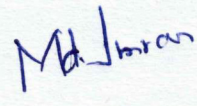
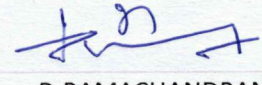
PURCHASE SPECIFICATION

DOC No: **SPEC:AC:001** Rev: **08**

Effective Date: **23/06/2022**

Page: **19** of **19**

Product: Specification for Electrical Actuator

Signature			
Name	M.VIJAYABHARATHI	MD.IMRAN	D.RAMACHANDRAN
Designation	ENGINEER	DY.MANAGER	SR.MANAGER
Date	23 June 2022	23 June 2022	23 June 2022
Action	Prepared By	Checked & Reviewed By	Approved By

Product: Electrical Actuator (With Integral starter, Plug & Socket and diagnostic module) with Gear Box combination

IMPORTANT INSTRUCTION:

- a) ***Vendor shall furnish point-to-point confirmation / deviation to each clause of this specification explicitly.***
- b) ***The offer shall be submitted along with all the documents required in this specification. Offer without all supporting documents requested in this specification will not be considered for Technical evaluation.***

Clause. No	Specification requirement	Vendor confirmation / comments / deviation
G.1.0	GENERAL	
G.1.1	The offered Actuator with Bevel Gear box shall be brand new with state of the art technology having a proven field track record. No prototype equipment shall be offered.	
G.1.2	Vendor shall ensure availability of spare parts and maintenance support services for the offered equipment for at least 10 years from the date of supply.	
G.1.3	Vendor shall give a notice of at least one year to the end user of equipment before phasing out the product/ spares to enable the end user to place order for spares and services.	
G.1.4	The vendor shall be responsible for design, engineering and manufacturing of the complete actuator and gear box to fully meet the intent and requirements of this specification.	
G.2.0	ENCLOSURE:	
G.2.1	Actuators including motor, integral starter, control transformer unit and all control devices shall be of totally enclosed weather proof and dust proof construction with min. IP 68 enclosure, which shall include the 'O' ring for complete environmental protection. The same shall be suitable for outdoor applications and capable of operating in ambient temperature of -20 deg.C to +70 deg.C. The motor operators/actuators shall conform to AWWA specification. Actuator with integral starter and 9 pin plug and socket arrangement shall be considered.	
G.3.0	VOLTAGE:	
G.3.1	The unit shall be suitable for operation on a 415V, 3 phases, 50Hz, 3-wire AC supply. All the internal power supply required for Starter unit and other accessories shall be derived from the above indicated power supply through control transformers.	

Clause. No	Specification requirement	Vendor confirmation / comments / deviation
G.4.0	CONSTRUCTION:	
G.4.1	The actuator with bevel gear box shall be suitable for mounting directly on the valve. The actuator along with Bevel gear box shall be capable of giving the required torque, rpm and thrust. Indicate the adjustable range of torque and starting torque of actuator with bevel gear box in kgm/Nm for each offered models. The maximum thrust capability of the actuators with bevel gear box shall also be furnished. The actuators with bevel gear box shall be designed to take the full thrust. All Gears used shall be metallic. Fiber gears are not acceptable. Metallic gear trains used shall be self-locking type to prevent drift. Indicate the maximum stem acceptance diameter in the offer. Gear operators are to be supplied with input flanges to suit the keyed shaft of the Electrical actuator. Details of the input flange for each model shall be furnished. The gear casing shall be designed adequately to withstand shock and vibration of the pipeline. The design shall be compact and less weight and shall not cause any trouble during operation at sites. Bevel gear box Enclosure protection shall be min IP65. The gear operator shall have base suitable to take the thrust with ball/roller bearings. An Aluminum Bronze drive sleeve with a pilot bore shall be provided as a standard supply. The drive sleeve will be threaded by BHEL to suit the stem thread. The assembly of all gears, shafts etc... shall be done properly to have smooth operation without any noise. The flange for connecting the valve shall have dimensions as per BHEL Requirement indicated in the table All Gear operators shall have provision to accommodate raising spindle of the valve and the hole shall be properly covered with a removable lid. The Gear box shall be supplied with stem protection tube to accommodate larger spindle travel. The length of stem protection cover shall be as indicated in the table. All the above parts, i.e. the threaded portion of Gear box, removable lids and stem protection tubes shall be able to withstand the prolonged outdoor storage without getting rusted or damaged.	
G.4.2	Actuator with Bevel gear box mounting arrangement with dimensions, the thread connection of the Stem Protection Cover shall be clearly furnished along with the offer. The flange dimension shall be as indicated elsewhere in this specification.	
G.4.3	The dimension drawing of the blank adopter bush shall be furnished along with the offer.	

Clause. No	Specification requirement	Vendor confirmation / comments / deviation
G.4.4	Each actuator shall have a hand wheel fitted on it for manual operation in case of power failure. It shall be possible to fully open /close the valve with the hand wheel. The hand wheel shall be designed such that its engaging lever declutches automatically when the power supply to the motor is restored. The material of the hand wheel shall be either malleable iron or steel. The hand wheel-engaging lever shall give trouble free performance under repeated operations. Side mounted hand wheel with gear / Top mounted hand wheel can be offered. The hand wheel construction shall be strong enough to withstand the impacts of normal handling and storage of actuator without any damage. The hand wheel shall be able support the weight of the actuator, without any damage to actuator or hand wheel, when actuator is rested on the hand wheel.	
G.4.5	Actuators offered shall be with self-locking worm.	
G.5.0	TECHNICAL DATA:	
G.5.1	Desired output shaft speeds are given below for different torque ranges. Actual speeds of actuators offered shall be clearly indicated.	
G.5.2	Actuator + Bevel gearbox combination shall have provision to set the Torque value from 40% of the maximum Torque mentioned in the below table.	

Actuators with bevel gearbox - Technical requirements

Sl.No	Maximum Torque (Kg-m)	RPM (Approx)	Output flange details	Thrust (Kgf)	Stem Protection Cover in mm (unless otherwise specified)
1	200	14	177.8x298.5-8NOS M20	32000	400
2	400	9	215.9x355.6-8 NOS M24	45000	400
3	500	9	215.9x355.6-8 NOS M24	63000	400
4	800	8	228.6x406.4-8NOS M30	82000	400
5	1050	8	228.6x406.4-8NOS M30	120000	500
6	1400	6	228.6x406.4-8NOS M30	130000	500

Clause. No	Specification requirement	Vendor confirmation / comments / deviation
G.6.0	WEIGHT:	
G.6.1	Furnish weight of actuator with bevel gear box including all accessories.	
G.7.0	LUBRICANT:	
G.7.1	Oil plugs shall be provided for filling and draining separately.	
G.7.2	The gearbox of the actuator shall be oil filled or grease filled. The oil/grease must be suitable for operation for 80 Deg. above ambient temperature. Furnish detail of lubricant used with Indian oil Company's BPCL & HPCL's equivalent. The actuator shall have proper seals to prevent leakage of oil at all installation positions. The actuator construction shall be such that the oil/grease does not leak to other compartments or outside. Incase of any complaint of such leakage, the complaint shall be attended free of cost within one week and root cause of the problem shall be eliminated within one month.	

Clause No	Specification requirement	Vendor confirmation / comments / deviation
G.8.0	DIMENSIONAL CATALOGUES:	
G.8.1	Two copies of catalogues of the actuators with bevel gear box in English language describing the constructional details shall be sent along with the offer. The catalogues shall also provide over all dimensions of the actuators, bevel gear box, mounting flange, maximum spindle acceptance diameters and other details called for in the specification.	
G.9.0	O & M INSTRUCTION MANUALS:	
G.9.1	a. One copy of Operating and Maintenance Instruction Manual shall accompany each actuator with bevel gear box ordered. b. One set of Operating and Maintenance Instruction Manual of each type of actuator with bevel gear box both in Hard copy and in Soft copy in CD (in pdf format) shall be sent to us before dispatch of the actuator.	
A.0	ACCESSORIES	
A.1.0	TORQUE SWITCHES::	
A.1.1	Two numbers adjustable torque switches (one for open and one for close) each with 4 NO and 4 NC potential free contacts. The type of torque switch like rotary/cam shall be mentioned in the offer.	
A.1.2	The torque switches shall have accuracy of plus or minus 3% of set value.	
A.1.3	A scale shall be provided for each torque switch to set required torque. Each division shall indicate actual value of torque. The scale-setting knob shall have locking screw to avoid any setting disturbance at site due to line vibration.	
A.1.4	Actuators shall have provision for bypassing the torque switch during initial 5% opening of valves. Details for this must be indicated in the wiring diagram.	
A.1.5	The wiring diagram shall include details of changes to be done for making the actuator suitable for torque seating or position seating valves.	
A.2.0	LIMIT SWITCHES:	
A.2.1	Two numbers of position limit switches (one for open and one for close) each with 2 NO and 2 NC potential free contacts. The type of limit switch like rotary/drum/cam type shall be mentioned in the offer.	
A.2.2	Two Auxiliary limit switches (one for open and one for close) each with 2 NO and 2 NC potential free contacts.	
A.2.3	Each limit switch shall be capable of being set to trip at any position independently between fully open and fully closed position.	
A.2.4	Limit switches and torque switches shall be weather proof suitable for damp atmospheres, and shall not cause any trouble during commissioning and operation.	
A.2.5	The torque and position limit switches shall be suitable for the following ratings, both 240 volts, AC, 5 amps and 220 volts DC, 0.5 amps. The insulation level between each set of contacts shall be minimum of 1.2KV for 1min.	
A.3.0	LOCAL POSITION INDICATORS:	
A.3.1	Each actuator shall have a local position indicator to indicate 0 to 100% of valve travel.	

Clause No	Specification requirement	Vendor confirmation / comments / deviation
A.3.2	The actuator with gearbox unit shall be suitable for operating different valve size with varying lifts. The actuators shall have adjustable gear for the local position indicator so that accurate indication of valve position can be obtained for all valve lifts by adjusting the gears. The gears selection chart for setting of local position indicator and mechanical transmitter for different valve lifts (output shaft revolutions) shall be furnished along with offer. Also one set of change gears shall be supplied along with each actuator.	
A.4.0	ANTI-CONDENSATION HEATER (SPACE HEATER):	
A.4.1	Each actuator shall have an anti-condensation heater in the limit switch compartment suitable for 240V AC 50 c/s single phase supply with thermostat for automatic switch ON/OFF Space heater based on the temperature inside limit switch compartment. The wattage of the heater shall be specified in the data sheet and wiring diagram shall represent the same.	
A.5.0	REMOTE POSITION TRANSMITTER:	
A.5.1	Open/Close actuator shall have two Nos. of resistance type position transmitter for remote indication. Rating of position transmitter 100ohms, 50 Volts, AC/DC. A suitable fixed dropping resistor must be put in series for limiting the power consumption.	
A.5.2	If enquiry item description contains “ CLEPT/CEPT/CPT ”, then inching duty actuators shall be considered. The same shall be offered with one no. of LVDT type (Non-contact type) electronic position transmitter, suitable for 24V DC with an output of 4-20mA and 2 wire system.	
M.0	MOTORS	
M.1.0	POWER SUPPLY:	
M.1.1	Motor shall be suitable for operation on a 415V, 3 phase, 3 wire ungrounded supply system.	
M.1.2	Motor shall operate without any trouble under the following conditions.	
	a. If the voltage varies within plus or minus 10% of the rated value of 415 Volts.	
	b. If the frequency of the power source varies within plus or minus 5% of 50 c/s.	
	c. If the voltage and frequency of the source vary simultaneously and the sum of the absolute percentage values in variation does not exceed 10%.	
M.2.0	CONSTRUCTION:	
M.2.1	Motor shall be totally enclosed with min IP 68 or better weatherproof enclosure and shall be suitable for outdoor installation without canopy. All electrical equipment, accessories and wiring shall be provided with tropical finish to prevent fungus growth. In case of any water leakage due to enclosure failure it shall be attended free of cost within one week and root cause of the problem shall be eliminated within one month	
M.2.2	Motor shall be conforming to IEC 60034 or any other equivalent international standard for all requirements unless otherwise specified herein.	
M.2.3	The enclosures shall be treated and prepared for painting with suitable painting system for withstanding 500Hrs of salt spray as per ASTM B-117/ ISO9227 standard. Motor shall be painted with corrosion proof epoxy resin paint. Paint shade shall be RAL 7032	

Clause No	Specification requirement	Vendor confirmation / comments / deviation
M.3.0	INSULATION:	
M.3.1	Motor shall have class F non-hygroscopic insulation with tropicalisation suitable for polluted dusty and corrosion atmospheres of relative humidity 100%. Motor shall be designed for an ambient temp of 70 degree C. However, the temperature rise of the motor winding shall be limited to the maximum temperature allowed for class 'B' insulation. It shall also be possible to rewind the motor in case the windings and insulation get burnt out.	
M.4.0	RATING:	
M.4.1	For ON/OFF Motors shall be S2-15 min. rating. This shall not be less than the highest of the following: 1) Fifteen minutes. 2) As required for three successive open/close operations For Inching service, 150 starts per hour shall be considered.	
M.5.0	STARTING:	
M.5.1	Motor shall be suitable for direct on-line starting.	
M.5.2	Starting current shall be limited to 6 times the full load current.	
M.5.3	Motor shall be capable of a. Starting at 85% of rated voltage. b. Running at 80% of rated voltage at rated torque for a period of 5 minutes c. Running at 85% of rated voltage at 33% excess rated torque for a period of 5 minutes d. The torque at reduced supply voltage shall be mentioned for 75% voltage, 80% voltage, 85% voltage & 90% voltage.	
M.6.0	BEARINGS:	
M.6.1	Bearing shall be of double shielded, grease lubricated antifriction type. The anticipated bearing life shall be indicated for all models.	
M.7.0	EARTHING TERMINALS:	
M.7.1	Two earthing terminals shall be provided on either side of the motor.	
M.8.0	MOTOR DATA:	
M.8.1	One set of hard and soft copies of motor data sheets for each type of actuators ordered shall be furnished as per format furnished.	
M.9.0	TESTS:	
M.9.1	Tests shall be carried out as per approved QP.	
C.0	CONTROLS	
C.1.0	INTERNAL WIRING:	
C.1.1	Internal wiring diagram shall be neatly pasted on cover of terminal box.	
C.1.2	Internal wiring shall be done with 1.5 sq.mm PVC insulated copper wires. Ferrules should be provided on both ends of the wire for easy identification.	

Clause No	Specification requirement	Vendor confirmation / comments / deviation
C.2.0	FEATURES APPLICABLE TO INTEGRAL STARTER	
C.2.1	The actuators shall have integral starters. Control supply shall be derived with step down transformer from 415V, 3PH incoming supply. Necessary primary and secondary fuses shall be provided. All the PCBs shall be protected against moisture by suitable coating and treatment. In case of failure of PCBs due to moisture entry, it shall be attended free of cost within one week and root cause of the problem shall be eliminated within one month	
C.2.2	Automatic phase correction facility and single phasing prevention shall be available.	
C.2.3	Lockable Selector switch for LOCAL-OFF-REMOTE selection with OPEN-STOP-CLOSE pushbuttons (for local operation) shall be provided.	
C.2.4	It should also be possible to reverse the direction of travel for inching valves (in LOCAL and REMOTE) without giving stop command.	
C.2.5	Lamp indication for full open, full close and in-travel positions shall be provided.	
C.2.6	Electrically and mechanically interlocked contactors shall be provided for forward and reverse operation. Contactor rating shall be sufficient to withstand the extreme conditions Like valve jamming and instantaneous reversal of motor.	
C.2.7	Potential free contacts for LOCAL-OFF- REMOTE positions shall be wired to terminals and available for customer connections.	
C.2.8	Open/Close command termination logic with position and torque set points shall be suitably built in the PCB inside the actuator.	
C.2.9	The selection of the following mode shall be available locally on actuator through suitable switch programming. It shall also be clearly described in wiring diagram. a) Valve seating by torque (close) or limit (close) shall be available. b) Inching (non self-retaining) or non-inching (self-retaining) for remote command and local mode shall be field configurable.	
C.2.10	Provision shall be there for bypassing the torque switch during initial 5% opening and closing of valves. Details for this must be indicated in the wiring diagram. This shall be done through electronic circuit or through one 'NC' contact of 'limit switch'.	
C.2.11	All the contacts of Main & Auxiliary limit switches and torque switches shall be wired up to terminal box for customer use.	
C.2.12	a) Actuator shall be suitable for remote operation by potential free contacts for open / close and stop, the necessary 24V DC power supply shall be derived internally. Also It shall be possible to energise the interposing relays provided (with coil burden $\leq 2.5\text{VA}$, one for open and one for close) to initiate opening and closing by 24V DC signal from the external control system, accordingly suitable isolated interface in the actuator shall be provided. b) Potential-free change-over contact for Open feedback, close feedback, system ready/ Ready to start feedback, Open torque acted feedback, Close torque acted feedback, OLR acted for connecting to remote DCS/PLC system	

Clause. No	Specification requirement	Vendor confirmation / comments / deviation
C.2.13	The actuator shall include a diagnostic module , which will store and enable down load historical down load operation and torque data to permit analysis of actuator and valve in service performance. Data down load shall be carried out without removing any covers and all shall be available locally to the actuator or remotely via telecommunication data transfer. Diagnostic and configuration software shall be made for user PC system.	
C.2.14	24V Power supply for Contact less EPT shall be derived internally.	
C.2.15	Thermal over load relay shall be provided in addition to thermostats embedded in motor winding. Overload relay and thermostats shall be connected in control circuit to trip actuator incase of overload. OLR set value shall be mentioned in wiring diagram/ Data sheets .	
C.2.16	A common potential free contact (monitoring relay) shall be available to annunciate the following faults. a) Thermostat trip b) OLR trip c) Valve jammed in mid-travel. d) Motor single phasing. e) Control supply failure. f) Local stop or local/remote selector switch in local mode.	
C.2.17	The following status annunciation shall be made available locally (integral to actuator) a) Actuator running in OPEN b) Actuator running in CLOSE c) Internal 24VDC Control voltage healthy d) 24VDC availability for customers use healthy.	
C.2.18	The following individual fault annunciation shall be made available locally (integral to Actuator)for easy trouble shooting a) Open Torque sensor acted b) Close Torque sensor acted c) Thermostat trip d) Thermal overload relay trip e) Motor single phasing f) Wrong phase sequence protection acted	
C.2.19	BLINKER RELAY: Blinker relay contact for remote indication of 'actuator running' is to be provided as a standard part of integral starter actuator.	
C.2.20	In the event of voltage dips/ power outage, status of MOVs (OPEN/ CLOSE indication) for remote annunciation shall not undergo any change. The wiring for all MOVs feedback controls shall be fail safe type. Any backup for power supply & hardware required for achieving the same shall be provided by vendor within the actuator. No other power supply other than 415V+/- 10%, three phase, 50Hz+/-3% incoming supply to each of MOV Actuator shall be provided.	
C.3.0	TERMINAL BOX:	
C.3.1	All terminals of position limit switches, torque limit switches, space heaters and position transmitters shall be brought to a common terminal board. The terminals shall be clip-on type/screw type with sufficient insulation between 2 adjacent terminals. All terminals must be suitable for 2 nos. of 2.5 sq.mm wires.	
C.3.2	Minimum 10 numbers of terminals shall be available in the terminal board as spare terminals.	

Clause. No	Specification requirement	Vendor confirmation / comments / deviation
C.3.3	Terminal box of actuator shall be weather proof. One Number PVC insulated armoured copper / aluminium conductor power cable (Exact Cable size will be furnished after ordering). Motor terminals shall be of stud type, screw type and press fit type depending on the power rating. Terminal box shall be fitted with a removable front cover plate. Termination of Control Cable :- 9 Pin plug & sockets (2 Nos. wired + 1 No. spare as loose supply) shall be provided to suit 4 pair 0.5 sq.mm. Copper overall shielded (16 mm OD), instrumentation cable. The socket shall be fixed on the terminal board and wired to the terminal blocks as per the wiring drawing.	
C.3.4	Default setting of torque switch, dial indicator on and torque/limit closing to be included in the documents.	
C.4.0	CABLE GLAND:	
C.4.1	Actuators are to be provided as a standard with one cable gland for power and 3 cable glands for control (Exact Cable OD will be furnished after ordering). All the cable glands shall be of double compression type and made of Ni plated Brass material. Un used cable entries shall be plugged with Ni plated Brass plugs with suitable sealing (like 'o' ring) to ensure IP68 or better protection.	
C.4.2	Preferably all the cable glands shall be provided on one direction (face) only. Wherever this is not technically feasible, the cable gland on the second side shall be provided with necessary elbows, so that all glands will be facing at one side.	
S.0	SPARES	
S.1.0	Supplier shall specify a list of recommended spares for 2/5 years trouble free operation. An exploded view of the actuator with bevel gear box shall be furnished with part numbers for identifying the spares.	
D.0	DOCUMENTS	
D.1.0	Furnish the following documents along with offer & after ordering:	
	a. Outline dimension of assembled motor with gear box. - GA drawings for all models (Motor with gearbox) including dismantling clearances and material specification of critical components. - The dimension drawing of the drive sleeve - Data sheet for all models, along with weight of the actuator - Dimensional catalogue with maximum spindle acceptance details - Wiring diagram for all models. - Gear selection chart for setting of local position indicator	
	b. Outline dimension of actuator with gear box.	
	c. Dimensional drawing of terminal showing the method of terminating incoming cables.	
	d. General arrangement drawing of actuator with gear box consisting following as minimum	
	e. Identification of critical component with its material composition.	

Clause. No	Specification requirement	Vendor confirmation / comments / deviation
	f. Mounting flange dimension	
	g. Hand wheel dimensions	
	h. Actuator cover removal clearances	
	i. Weight of actuator + gear box with and without integral starter	
	j. Stem protection cover length, thread size and type	
	k. Double compression cable gland & plugs	
	l. Separate drawing for details of cable gland cross section, min/ max. cable OD that can be accommodated, critical dimension etc.	
	m. Quality plan	
	n. Type test certificates	
	o. Default settings of torque, dial indicator and torque/limit closing for all models.	
T.0	TEST REQUIREMENTS FOR ACTUATORS	
T.1.0	ROUTINE TEST:	
T.1.1	Dimensions: Overall and mounting	
T.1.2	Details of painting as per specification and vendor practice: Anti-corrosiveness Epoxy.	
	i. Shade.	
	ii. Finish	
	iii. Paint thickness	
T.1.3.	Manual operation through hand wheel.	
T.1.4.	Testing of position and torque limit Sensors for accuracy and repeatability.	
T.1.5.	Hand-Auto switching function.	
T.1.6	For motors, all routine tests as called in IEC- 60034 from motor manufacturer.	
T.1.7	Output shaft speed and torque of actuator and corresponding current.	
T.1.8	Stall current and stall torque for the actuator assembly.	
T.1.9	a. Position indicator and transmitter: Calibration check for accuracy, linearity and repeatability.	
	b. Functional test for electronic position transmitter (If applicable).	
T.1.10	Leakage test for gear case (visual).	
T.1.11	HV test at 1.6 KV (80% of 2 KV) for the assembled actuator.	
T.1.12	Operation of actuator under variation in supply voltage (plus or minus 10%) for verifying rated torque and speed.	
T.1.13	Checking of wiring as per approved wiring diagram	
T.1.14	The following tests are applicable for integral starter actuators	
	a. Functional test for local / remote / off selection	
	b. Open/close/stop operation in local and remote mode.	
	c. OLR tripping	
	d. Functional test, temperature raise test and burn-in test on PCB	
T.2.0	TYPE TEST certificates shall be provided for the following tests.	
T.2.1.	Type test for motor as per IEC- 60034	
T.2.2.	Noise and vibration test for total assembly IS: 4729/BS 4999.	
T.2.3.	Temperature rise test during:	
	a. Operation of actuator at 90% voltage.	
	b. Operation of actuator at 50 degree C ambient.	
T.2.4.	Operation with variation in frequency (plus or minus 5%) for verifying rated torque and speed.	
T.2.5.	Enclosure protection for the total assembly.	

Clause No	Specification requirement	Vendor confirmation / comments / deviation
T.2.6.	Endurance test for actuator.	
T.2.7.	Endurance test for limit sensors (if applicable)	
T.2.8.	Damp heat cycle test as per IS:9000/IEC 68-30.	
T.2.9.	Following test are applicable for integral starter actuators	
	a. Type test on bare PCB	
	b. Life cycle test	
T.3.0.	The gear operator shall be tested to the design requirement of torque and thrust and type test certificates shall be furnished. The mechanical efficiency shall not be less than 95%.	
T.3.1.	Certificate for routine test.	
T.3.2.	Routine and type test reports for motors.	
T.3.3.	Type test report for all tests listed under 'T.2.0'	
T.3.4.	TC for endurance test for limit sensor and torque sensor (if applicable).	
T.3.5	The gear operator shall be tested to the design requirement of torque and thrust and type test certificates shall be furnished. The mechanical efficiency shall not be less than 95%.	
N.1.0	NOTES:	
N.1.1.	The supplier shall submit quality plan covering quality checks carried out in different stages of procurement process, manufacturing assembly, testing and final inspection stage. These quality plans shall be approved by BHEL.	
N.1.2.	All testing facilities shall be arranged by the vendor, at his works before calling BHEL / TPI representative for inspection.	
N.1.3.	Approved drgs., PO specification and relevant standards if any shall be made available during testing / inspection.	
N.1.4.	All measuring and testing instruments shall be periodically calibrated from National test house and certificates made available during inspection.	
N.1.5	All relevant GA drawings, data sheets & wiring diagrams shall be submitted as controlled copy and approval shall be obtained from BHEL. All supply shall be as per these documents.	
N.1.6	Nameplate: Each motorized valve actuator with gear box shall be provided with a stainless steel nameplate furnishing the following details as minimum, attached firmly to it at a place convenient for reading: Actuator: a) Actuator tag number as per data sheet b) Motor kW rating, motor short time rating, motor supply voltage, nominal motor phase current, auxiliary switch rating c) Maximum torque setting d) Actuator enclosure type, lubricant type e) Actuator type, wiring diagram number/ catalogue number, actuator serial number. Gearbox: Make, Model Number, Serial Number, Output Torque, Permissible Thrust, Gear Ratio.	

Clause. No	Specification requirement	Vendor confirmation / comments / deviation
N 1.7	Packing &Transport: The actuator with gearbox unit shall be supplied to site packed in wooden crates / Carton boxes. They shall be wrapped with polythene sheets. They shall have skid bottoms for handling. All spares shall be packed separately in boxes marked SPARE. Special precaution notations such as Fragile. This side up, center of gravity, weight, Owner's particulars. Purchase number etc. shall be clearly marked on the package together with other details as per purchase order. The equipment shall be properly packed for the selected mode of transportation whether indigenous or imported, i.e. by ship, rail or trailer. If the equipment is supplied through ship, Sea worthy packing shall be considered to prevent damage.	

DATE	DESCRIPTION	PREPARED & CHECKED	APPROVED
11.01.2020	INITIAL RELEASE	D. Kavitha	K.Chinnasamy
20.04.2020	Revised	D. Kavitha	K.Chinnasamy



365-147/B
31.08.16

BHEL – Tiruchirappalli – 620014, India

Valves Engineering and R&D

PURCHASE SPECIFICATION

DOC No: **SPEC: AC: IS: DIA: Rev: 01**

Effective Date: **20/04/2020**

Product: Electrical Actuator (With Integral starter, Plug & Socket and diagnostic module)

IMPORTANT INSTRUCTION:

- a) ***Vendor shall furnish point-to-point confirmation / deviation to each clause of this specification explicitly.***
- b) ***The offer shall be submitted along with all the documents required in this specification. Offer without all supporting documents requested in this specification will not be considered.***

Clause. No	Specification requirement	Vendor confirmation / comments / deviation
G.1.0	GENERAL	
G.1.1	The offered Actuator shall be brand new with state of the art technology having a proven field track record. No prototype equipment shall be offered.	
G.1.2	Vendor shall ensure availability of spare parts and maintenance support services for the offered equipment for at least 10 years from the date of supply.	
G.1.3	Vendor shall give a notice of at least one year to the end user of equipment before phasing out the product/ spares to enable the end user to place order for spares and services.	
G.1.4	The vendor shall be responsible for design, engineering and manufacturing of the complete actuator to fully meet the intent and requirements of this specification.	
G.2.0	ENCLOSURE:	
G.2.1	Actuators including motor, integral starter, control transformer unit and all control devices shall be of totally enclosed weather proof and dust proof construction with min. IP 68 enclosure, which shall include the 'O' ring for complete environmental protection. The same shall be suitable for outdoor applications and capable of operating in ambient temperature of -20 deg.C to +70 deg.C. The motor operators/actuators shall conform to AWWA specification. Actuator with integral starter and 9 pin plug and socket arrangement shall be considered.	
G.3.0	VOLTAGE:	
G.3.1	The unit shall be suitable for operation on a 415V, 3 phases, 50Hz, 3-wire AC supply. All the internal power supply required for Starter unit and other accessories shall be derived from the above indicated power supply through control transformers.	

Clause No	Specification requirement	Vendor confirmation / comments / deviation
G.4.0	CONSTRUCTION:	
G.4.1	Actuators shall have provision to accommodate raising spindle of the valve and the hole shall be properly covered with a removable lid. The actuator shall be supplied with stem protection tube to accommodate larger spindle travel as indicated elsewhere in this specification. All the above parts, i.e. The threaded portion of actuator, removable lids and stem protection tubes shall be able to withstand the prolonged outdoor storage without getting rusted or damaged.	
G.4.2	The actuator shall be suitable for mounting directly on the valve. The actuator shall be capable of giving the required torque, rpm and thrust. The actuator shall be suitable for mounting in any position. Indicate the adjustable range of torque and starting torque of actuator in kgm/Nm for each actuator offered. The maximum thrust capability of the actuators shall also be furnished. The actuators shall be designed to take the full thrust. All Gears used shall be metallic. Fiber gears are not acceptable. Metallic gear trains used shall be self-locking type to prevent drift.	
G.4.3	Actuator shall have thrust base with blank removable adaptor bush of aluminum bronze, which can be threaded to accommodate raising spindles of valve.	
G.4.4	The exact mounting arrangement with dimensions shall be clearly furnished along with the offer. The flange dimension shall be as indicated elsewhere in this specification.	
G.4.5	The dimension drawing of the blank adopter bush shall be furnished along with the offer.	
G.4.6	Each actuator shall have a hand wheel fitted on it for manual operation in case of power failure. It shall be possible to fully open /close the valve with the hand wheel. The hand wheel shall be designed such that its engaging lever declutches automatically when the power supply to the motor is restored. The material of the hand wheel shall be either malleable iron or steel. The hand wheel-engaging lever shall give trouble free performance under repeated operations. Side mounted hand wheel with gear / Top mounted hand wheel can be offered. The hand wheel construction shall be strong enough to withstand the impacts of normal handling and storage of actuator without any damage. The handwheel shall be able support the weight of the actuator, without any damage to actuator or hand wheel, when actuator is rested on the hand wheel.	
G.4.7	Actuators offered shall be with self-locking worm.	
G.5.0	REVOLUTIONS:	
G.5.1	Desired output shaft speeds are given below for different torque ranges. Actual speeds of actuators offered shall be clearly indicated.	
G.5.2	Actuator shall have provision to set the Torque value from 40% of the maximum Torque mentioned in the below table.	

Actuators -Technical requirements

Sl.No	Maximum Torque (Kg-m)	RPM (Approx)	Out put flange details (LD x PCD x Bolt Details.)	Stem Protection Cover in mm (unless otherwise specified)
1	3.5	18	60 x 102 x 4Nos M10	100
2	6	24	60 x 102 x 4Nos M10	100
3	15	36	60 x 102 x 4Nos M10	150
4	30	36	100 x 140 x 4Nos M16	250
5	50	36	127 x 165 x 4Nos M20	300
6	60	96	100 x 140 x 4Nos M16	400
7	80	36	152 x 254 x 8Nos M16	400
8	100	96	127 x 165 x 4Nos M16	500
9	200	32	152 x 254 x 8Nos M16	400
10	400	32	177.8x298.5-8NOS M20	400
11	700	22	215.9x355.6-8 NOS M24	400
12	1100	22	228.6x406.4-8NOS M30	500
13	1600	22	228.6x406.4-8NOS M30	500

Clause. No	Specification requirement	Vendor confirmation / comments / deviation
G.6.0	WEIGHT:	
G.6.1	Furnish weight of actuator including all accessories.	
G.7.0	LUBRICANT:	
G.7.1	Oil plugs shall be provided for filling and draining separately.	
G.7.2	The gearbox of the actuator shall be oil filled or grease filled. The oil/grease must be suitable for operation for 80 Deg. above ambient temperature. Furnish detail of lubricant used with Indian oil Company's BPCL & HPCL's equivalent. The actuator shall have proper seals to prevent leakage of oil at all installation positions. The actuator construction shall be such that the oil/grease does not leak to other compartments or outside. In case of any complaint of such leakage, the complaint shall be attended free of cost within one week and root cause of the problem shall be eliminated within one month.	
G.8.0	DIMENSIONAL CATALOGUES:	
G.8.1	Two copies of catalogues of the actuators in English language describing the constructional details shall be sent along with the offer. The catalogues shall also provide over all dimensions of the actuators, maximum spindle acceptance diameters and other details called for in the specification.	
G.9.0	O & M INSTRUCTION MANUALS:	
G.9.1	a. One copy of Operating and Maintenance Instruction Manual shall accompany each actuator ordered. b. One set of Operating and Maintenance Instruction Manual of each type of actuator both in Hard copy and in Soft copy in CD (in pdf format) shall be sent to us before dispatch of the actuator.	

Clause No	Specification requirement	Vendor confirmation / comments / deviation
A.0	ACCESSORIES	
A.1.0	TORQUE SWITCHES::	
A.1.1	Two numbers adjustable torque switches (one for open and one for close) each with 4 NO and 4 NC potential free contacts. The type of torque switch like rotary/cam shall be mentioned in the offer.	
A.1.2	The torque switches shall have accuracy of plus or minus 3% of set value.	
A.1.3	A scale shall be provided for each torque switch to set required torque. Each division shall indicate actual value of torque. The scale-setting knob shall have locking screw to avoid any setting disturbance at site due to line vibration.	
A.1.4	Actuators shall have provision for bypassing the torque switch during initial 5% opening of valves. Details for this must be indicated in the wiring diagram.	
A.1.5	The wiring diagram shall include details of changes to be done for making the actuator suitable for torque seating or position seating valves.	
A.2.0	LIMIT SWITCHES:	
A.2.1	Two numbers of position limit switches (one for open and one for close) each with 2 NO and 2 NC potential free contacts. The type of limit switch like rotary/drum/cam type shall be mentioned in the offer.	
A.2.2	Two Auxiliary limit switches (one for open and one for close) each with 2 NO and 2 NC potential free contacts.	
A.2.3	Each limit switch shall be capable of being set to trip at any position independently between fully open and fully closed position.	
A.2.4	Limit switches and torque switches shall be weather proof suitable for damp atmospheres, and shall not cause any trouble during commissioning and operation.	
A.2.5	The torque and position limit switches shall be suitable for the following ratings, both 240 volts, AC, 5 amps and 220 volts DC, 0.5 amps. The insulation level between each set of contacts shall be minimum of 1.2KV for 1min.	
A.3.0	LOCAL POSITION INDICATORS:	
A.3.1	Each actuator shall have a local position indicator to indicate 0 to 100% of valve travel.	
A.3.2	The actuator shall be suitable for operating different valve size with varying lifts. The actuators shall have adjustable gear for the local position indicator so that accurate indication of valve position can be obtained for all valve lifts by adjusting the gears. The gears selection chart for setting of local position indicator and mechanical transmitter for different valve lifts (output shaft revolutions) shall be furnished along with offer. Also one set of change gears shall be supplies along with each actuator.	
A.4.0	ANTI-CONDENSATION HEATER (SPACE HEATER):	
A.4.1	Each actuator shall have a anti-condensation heater in the limit switch compartment suitable for 240V AC 50 c/s single phase supply with thermostat for automatic switch ON/OFF Space heater based on the temperature inside limit switch compartment. The wattage of the heater shall be specified in the data sheet and wiring diagram indicating the same.	
A.5.0	REMOTE POSITION TRANSMITTER:	
A.5.1	Open/Close actuator shall have two Nos. of resistance type position transmitter for remote indication. Rating of position transmitter 100ohms, 50 Volts, AC/DC. A suitable fixed dropping resistor must be put in series for limiting the power consumption.	

Clause No	Specification requirement	Vendor confirmation / comments / deviation
A.5.2	For inching duty applications, actuators shall have one electronic position transmitter (EPT), suitable for 24V DC with an output of 4-20mA and 2 wire system. LVDT type shall be offered.	
M.0	MOTORS	
M.1.0	POWER SUPPLY:	
M.1.1	Motor shall be suitable for operation on a 415V, 3 phase, 3 wire ungrounded supply system.	
M.1.2	Motor shall operate without any trouble under the following conditions.	
	a. If the voltage varies within plus or minus 10% of the rated value of 415 Volts.	
	b. If the frequency of the power source varies within plus or minus 5% of 50 c/s.	
	c. If the voltage and frequency of the source vary simultaneously and the sum of the absolute percentage values in variation does not exceed 10%.	
M.2.0	CONSTRUCTION:	
M.2.1	Motor shall be totally enclosed with min IP 68 or better weatherproof enclosure and shall be suitable for outdoor installation without canopy. All electrical equipment, accessories and wiring shall be provided with tropical finish to prevent fungus growth. In case of any water leakage due to enclosure failure it shall be attended free of cost within one week and root cause of the problem shall be eliminated within one month	
M.2.2	Motor shall be conforming to IEC 60034 or any other equivalent international standard for all requirements unless otherwise specified herein.	
M.2.3	The enclosures shall be treated and prepared for painting with suitable painting system for withstanding 500Hrs of salt spray as per ASTM B-117/ ISO9227 standard.	
	Motor shall be painted with corrosion proof epoxy resin paint. Paint shade shall be RAL 7032	
M.3.0	INSULATION:	
M.3.1	Motor shall have class F non-hygroscopic insulation with tropicalisation suitable for polluted dusty and corrosion atmospheres of relative humidity 100%. Motor shall be designed for an ambient temp of 70 degree C. However, the temperature rise of the motor winding shall be limited to the maximum temperature allowed for class 'B' insulation. It shall also be possible to rewind the motor in case the windings and insulation get burnt out.	
M.4.0	RATING:	
M.4.1	For ON/OFF Motors shall be S2-15 min. rating. This shall not be less than the highest of the following: 1) Fifteen minutes. 2) As required for three successive open/close operations	
	For regulating service, 150 starts per hour shall be considered.	
M.5.0	STARTING:	
M.5.1	Motor shall be suitable for direct on-line starting.	
M.5.2	Starting current shall be limited to 6 times the full load current.	

Clause No	Specification requirement	Vendor confirmation / comments / deviation
M.5.3	Motor shall be capable of a. Starting at 85% of rated voltage. b. Running at 80% of rated voltage at rated torque for a period of 5 minutes c. Running at 85% of rated voltage at 33% excess rated torque for a period of 5 minutes d. The torque at reduced supply voltage shall be mentioned for 75% voltage, 80% voltage, 85% voltage & 90% voltage.	
M.6.0	BEARINGS:	
M.6.1	Bearing shall be of double shielded, grease lubricated antifriction type. The anticipated bearing life shall be indicated for all models.	
M.7.0	EARTHING TERMINALS:	
M.7.1	Two earthing terminals shall be provided on either side of the motor.	
M.8.0	MOTOR DATA:	
M.8.1	One set of hard and soft copies of motor data sheets for each type of actuators ordered shall be furnished as per format furnished.	
M.9.0	WEIGHT	
M.9.1	Weight of the actuator shall be furnished separately along with the offer.	
M.10.0	TESTS:	
M.10.1	Tests shall be carried out as per approved QP.	
C.0	CONTROLS	
C.1.0	INTERNAL WIRING:	
C.1.1	Internal wiring diagram shall be neatly pasted on cover of terminal box.	
C.1.2	Internal wiring shall be done with 1.5 sq.mm PVC insulated copper wires. Ferrules should be provided on both ends of the wire for easy identification.	
C.2.0	FEATURES APPLICABLE TO INTEGRAL STARTER	
C.2.1	The actuators shall have integral starters. Control supply shall be derived with step down transformer from 415V, 3 PH incoming supply. Necessary primary and secondary fuses shall be provided. All the PCBs shall be protected against moisture by suitable coating and treatment - in case of failure of PCBs due to moisture entry. It shall be attended free of cost within one week and root cause of the problem shall be eliminated within one month	
C.2.2	Automatic phase correction facility and single phasing prevention shall be available.	
C.2.3	Lockable Selector switch for LOCAL-OFF-REMOTE selection with OPEN-STOP-CLOSE push buttons (for local operation) shall be provided.	
C.2.4	It should also be possible to reverse the direction of travel for inching valves (in LOCAL and REMOTE) without giving stop command.	
C.2.5	lamp indication for full open, full close and in-travel positions shall be provided.	
C.2.6	Electrically and mechanically interlocked contactors shall be provided for forward and reverse operation. Contactor rating shall be sufficient to withstand the extreme conditions like valve jamming and instantaneous reversal of motor.	
C.2.7	Potential free contacts for LOCAL-OFF-REMOTE positions shall be wired to terminals and available for customer connections.	
C.2.8	Open/Close command termination logic with position and torque set points shall be suitably built in the PCB inside the actuator.	

Clause. No	Specification requirement	Vendor confirmation / comments / deviation
C.2.9	The selection of the following mode shall be available locally on actuator through suitable switch programming. It shall also be clearly described in wiring diagram. a) Valve seating by torque (close) or limit (close) shall be available. b) Inching (non self-retaining) or non-inching (self-retaining) for remote command and local mode shall be field configurable.	
C.2.10	Provision shall be there for bypassing the torque switch during initial 5% opening and closing of valves. Details for this must be indicated in the wiring diagram. This shall be done through electronic circuit or through one 'NC' contact of 'limit switch'.	
C.2.11	All the contacts of Main & Auxiliary limit switches and torque switches shall be wired up to terminal box for customer use.	
C.2.12	a) Actuator shall be suitable for remote operation by potential free contacts for open / close and stop, the necessary 24V DC power supply shall be derived internally. Also It shall be possible to energise the interposing relays provided (with coil burden $\leq 2.5\text{VA}$, one for open and one for close) to initiate opening and closing by 24V DC signal from the external control system, accordingly suitable isolated interface in the actuator shall be provided. b) Potential-free change-over contact for Open feedback, close feedback, system ready/ Ready to start feedback, Open torque acted feedback, Close torque acted feedback, OLR acted for connecting to remote DCS/PLC system	
C.2.13	The actuator shall include a diagnostic module , which will store and enable down load historical down load operation and torque data to permit analysis of actuator and valve in service performance. Data down load shall be carried out without removing any covers and all shall be available locally to the actuator or remotely via telecommunication data transfer. Diagnostic and configuration software shall be made for user PC system.	
C.2.14	24V Power supply for EPT shall be derived internally.	
C.2.15	Thermal overload relay shall be provided in addition to thermostats embedded in motor winding. Overload relay and thermostats shall be connected in control circuit to trip actuator in case of overload. OLR set value shall be mentioned in wiring diagram / Data sheets .	
C.2.16	A common potential free contact (monitoring relay) shall be available to annunciate the following faults. a) Thermostat trip b) OLR trip c) Valve jammed in mid-travel. d) Motor single phasing. e) Control supply failure. f) Local stop or local/remote selector switch in local mode.	
C.2.17	The following status annunciation shall be made available locally (integral to actuator) a) Actuator running in OPEN b) Actuator running in CLOSE c) Internal 24V DC Control voltage healthy d) 24V DC availability for customers use healthy.	

Clause No	Specification requirement	Vendor confirmation / comments / deviation
C.2.18	The following individual fault annunciation shall be made available locally (integral to Actuator) for easy trouble shooting a) Open Torque sensor acted b) Close Torque sensor acted c) Thermostat trip d) Thermal overload relay trip e) Motor single phasing f) Wrong phase sequence protection acted	
C.2.21	BLINKER RELAY: Blinker relay contact for remote indication of 'actuator running' is to be provided as a standard part of integral starter actuator.	
C.2.22	In the event of voltage dips/ power outage, status of MOVs (OPEN/ CLOSE indication) for remote annunciation shall not undergo any change. The wiring for all MOVs feedback controls shall be fail safe type. Any backup for power supply & hardware required for achieving the same shall be provided by vendor within the actuator. No other power supply other than 415V+/-10%, three phase, 50Hz+/-3% incoming supply to each of MOV Actuator shall be provided.	
C.3.0	TERMINAL BOX:	
C.3.1	All terminals of position limit switches, torque limit switches, space heaters and position transmitters shall be brought to a common terminal board. The terminals shall be clip-on type/screw type with sufficient insulation between 2 adjacent terminals. All terminals must be suitable for 2 nos. of 2.5 sq.mm wires.	
C.3.2	Minimum 10 numbers of terminals shall be available in the terminal board as spare terminals.	
C.3.3	Terminal box of actuator shall be weather proof. One Number PVC insulated armoured copper / aluminium conductor power cable (Exact Cable size will be furnished after ordering). Motor terminals shall be of stud type, screw type and press fit type depending on the power rating. Terminal box shall be fitted with a removable front cover plate. Termination of Control Cable :- 9 Pin plug & sockets (2 Nos. wired + 1 No. spare as loose supply) shall be provided to suit 4 pair 0.5 sq.mm. Copper overall shielded (16 mm OD), instrumentation cable. The socket shall be fixed on the terminal board and wired to the terminal blocks as per the wiring drawing.	
C.3.4	DEFAULT SETTING OF TORQUE SWICTH, DIAL INDICATOR ON AND TORQUE/LIMIT CLOSING. The requirement of the default setting of torque switch, dial indicator and torque closing/limit closing selections are already provided by BHEL for all models. The same has to be followed. The list of default setting to be included in the documents.	
C.4.0	CABLE GLAND:	
C.4.1	Actuators are to be provided as a standard with one cable gland for power and 3 cable glands for control (Exact Cable OD will be furnished after ordering). All the cable glands shall be of double compression type and made of Ni plated Brass material. Un used cable entries shall be plugged with Ni plated Brass plugs with suitable sealing (like 'o' ring) to ensure IP68 or better protection.	

Clause. No	Specification requirement	Vendor confirmation / comments / deviation
C.4.2	Preferably all the cable glands shall be provided on one direction (face) only. Wherever this is not technically feasible, the cable gland on the second side shall be provided with necessary elbows, so that all glands will be facing at one side.	
C.5.0	FEATURES APPLICABLE TO FLAMEPROOF ACTUATORS	
C.5.1	Actuators along with its accessories (like cable gland, plug, plug and socket etc) meant for hazardous area shall meet the requirements of latest IS 2148/IEC60079, IEC –79 or equivalent International Standards.	
C.5.2	ENVIRONMENT: • Area Classification: Class 1, Zone 1 & Zone 2 • Gas Group: IIA & IIB. • Temperature Class (As per IEC-79):T3 • Construction: Flame Proof Ex(d) as per IS 2148/IEC60079	
C.5.3	Indigenous equipment shall be certified by CIMFR and approved by PESO and DGFASLI and shall carry the BIS License Marking. All the certification shall be valid at the time of delivery.	
C.5.4	Imported equipment shall be tested and certified by an independent certifying agency of country of equipment origin.	
S.0	SPARES	
S.0.1	Supplier shall specify a list of recommended spares for 2/5 years trouble free operation. An exploded view of the actuator shall be furnished with part numbers for identifying the spares.	
D.0	DOCUMENTS	
D.0.1	Furnish the following documents along with offer & after ordering: - Outline dimension of assembled motor. • GA drawings for all models including dismantling clearances. • The dimension drawing of the blank adopter bush • Data sheet for all models. Along with weight of the actuator • Dimensional catalogue with maximum spindle acceptance details • Wiring diagram for all models. • Gear selection chart for setting of local position indicator - Outline dimension of actuator. - Dimensional drawing of terminal showing the method of terminating incoming cables. - General arrangement drawing of actuator consisting following as minimum - Identification of critical component with its material composition. - Mounting flange dimension - Hand wheel dimensions - Actuator cover removal clearances - Weight of actuator with and without integral starter - Stem protection cover length, thread size and type - Double compression cable gland & plugs - Separate drawing for details of cable gland cross section, min/ max. cable OD that can be accommodated, critical dimension etc. - Quality plan - Type test certificates - Default settings of torque, dial indicator and torque/limit closing for all models.	

Clause No	Specification requirement	Vendor confirmation / comments / deviation
T.0	TEST REQUIREMENTS FOR ACTUATORS	
T.1.0	ROUTINE TEST:	
T.1.1	Dimensions: Overall and mounting	
T.1.2	Details of painting as per specification and vendor practice: Anti-corrosiveness Epoxy.	
	i. Shade.	
	ii. Finish	
	iii. Paint thickness	
T.1.3.	Manual operation through hand wheel.	
T.1.4.	Testing of position and torque limit Sensors for accuracy and repeatability.	
T.1.5.	Hand-Auto switching function.	
T.1.6	For motors, all routine tests as called in IEC- 60034 from motor manufacturer.	
T.1.7	Output shaft speed and torque of actuator and corresponding current.	
T.1.8	Stall current and stall torque for the actuator assembly.	
T.1.9	a. Position indicator and transmitter: Calibration check for accuracy, linearity and repeatability.	
	b. Functional test for electronic position transmitter (If applicable).	
T.1.10	Leakage test for gear case (visual).	
T.1.11	HV test at 1.6 KV (80% of 2 KV) for the assembled actuator.	
T.1.12	Operation of actuator under variation in supply voltage (plus or minus 10%) for verifying rated torque and speed.	
T.1.13	Checking of wiring as per approved wiring diagram	
T.1.14	The following tests are applicable for integral starter actuators	
	a. Functional test for local / remote / off selection	
	b. Open/close/stop operation in local and remote mode.	
	c. OLR tripping	
	d. Functional test, temperature raise test and burn-in test on PCB	
T.2.0	TYPE TEST certificates shall be provided for the following tests.	
T.2.1.	Type test for motor as per IEC- 60034	
T.2.2.	Noise and vibration test for total assembly IS: 4729/BS 4999.	
T.2.3.	Temperature rise test during:	
	a. Operation of actuator at 90% voltage.	
	b. Operation of actuator at 50 degree C ambient.	
T.2.4.	Operation with variation in frequency (plus or minus 5%) for verifying rated torque and speed.	
T.2.5.	Enclosure protection for the total assembly.	
T.2.6.	Endurance test for actuator.	
T.2.7.	Endurance test for limit sensors (if applicable)	
T.2.8	Damp heat cycle test as per IS:9000/IEC 68-30.	
T.2.9	Following test are applicable for integral starter actuators	
	a. Type test on bare PCB	
	b. Life cycle test	
T.2.10.	BIS and CMRI/PESO certificate for flame proof actuators	
T.3.0	DOCUMENTS TO BE PROVIDED:	
T.3.1.	Certificate for routine test.	
T.3.2.	Routine and type test reports for motors.	
T.3.3.	Type test report for all tests listed under 'T.2.0'	
T.3.4.	TC for endurance test for limit sensor and torque sensor (if applicable).	

Clause No	Specification requirement	Vendor confirmation / comments / deviation
N.1.0	NOTES:	
N.1.1.	The supplier shall also submit quality plan covering quality checks carried out in different stages of procurement process, manufacturing assembly, testing and final inspection stage. These quality plans shall be approved by BHEL.	
N.1.2.	All testing facilities shall be arranged by the vendor, at his works before calling BHEL / TPI representative for inspection.	
N.1.3.	Approved drgs., PO specification and relevant standards if any shall be made available during testing / inspection.	
N.1.4.	All measuring and testing instruments shall be periodically calibrated from National test house and certificates made available during inspection.	
N.1.5	All relevant GA drawings, data sheets & wiring diagrams shall be submitted as controlled copy and approval shall be obtained from BHEL. All supply shall be as per these documents.	
N.1.6	Nameplate: Each motorized valve actuator shall be provided with a stainless steel nameplate furnishing the following details as minimum, attached firmly to it at a place convenient for reading: a) Actuator tag number as per data sheet b) Motor kW rating, motor short time rating, motor supply voltage, nominal motor phase current, auxiliary switch rating c) Maximum torque setting d) Actuator enclosure type, lubricant type e) Actuator type, wiring diagram number/ catalogue number, actuator serial number. f) Apart from the nameplate indicating the tag no., a separate nameplate shall also be provided on each actuator to indicate the Details of the testing agency (CIMFR or equivalent), test certificate number with date, statutory approval number with date, approval agency (PESO / equivalent).	
N 1.7	Packing & Transport: The actuator shall be supplied to site packed in wooden crates / Carton boxes. They shall be wrapped with polythene sheets. They shall have skid bottoms for handling. All spares shall be packed separately in boxes marked SPARE. Special precaution notations such as Fragile. This side up, center of gravity, weight, Owner's particulars. Purchase number etc. shall be clearly marked on the package together with other details as per purchase order. The equipment shall be properly packed for the selected mode of transportation whether indigenous or imported, i.e. by ship, rail or trailer. If the equipment is supplied through ship, Sea worthy packing shall be considered to prevent damage.	

DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED
09/09/2019	INITIAL RELEASE	J. Krishna		D. Kavitha
20/04/2020	Revised	D.kavitha		K.Chinnasamy



365-147/B
31.08.16

BHEL– Tiruchirappalli– 620014, India

Valves Engineering and R&D

PURCHASE SPECIFICATION

DOC No: SPEC:AC+GB:IS:NI8:HWD: Rev:00

Effective Date:06.07.2023

Product: Electrical Actuator with integral starter(NON-INTRUSIVE type with SIL certification with Profibus / Hardwired interfacing)

IMPORTANT INSTRUCTION:

- a) Vendor shall furnish point-to-point confirmation / deviation to each clause of this specification explicitly.
- b) The offer shall be submitted along with all the documents (Datasheet, wiring diagram, QP, GAD, PTR) required in this specification. Offer without all supporting documents requested in this specification will not be considered.
- c) For High torque (> 1000 Nm) electric actuators: Vendor may propose non-intrusive actuators without SIL2 certification.
- d) For NTPC projects the paint shade shall be as per the NTPC approved shade.
- e) For actuator speciality, control function & constructions are in line with the specification of SPEC:AC:NI2: REV:00.

Clause. No	Specification requirement	Vendor confirmation / comments / deviation
G.1.0	GENERAL	
G.1.1	The offered Actuator with Bevel Gear box shall be brand new with state of the art technology having a proven field track record. No prototype equipment shall be offered.	
G.1.2	Vendor shall ensure availability of spare parts and maintenance support services for the offered equipment for at least 10 years from the date of supply.	
G.1.3	Vendor shall give a notice of at least one year to the end user of equipment before phasing out the product/ spares to enable the end user to place order for spares and services.	
G.1.4	The vendor shall be responsible for design, engineering and manufacturing of the complete actuator and gear box to fully meet the intent and requirements of this specification.	
G.2.0	ENCLOSURE:	
G.2.1	Actuators including motor, integral starter, control transformer unit and all control devices shall be of totally enclosed weather proof and dust proof construction with min. IP 68 enclosure, which shall include the 'O' ring for complete environmental protection. The same shall be suitable for outdoor applications and capable of operating in ambient temperature of -20 deg.C to +70 deg.C. The motor operators/actuators shall conform to AWWA specification. Actuator with integral starter and 9 pin plug and socket arrangement shall be considered.	

G.3.0	VOLTAGE:	
Clause. No	Specification requirement	Vendor confirmation/ comments/ deviation
G.3.1	The unit shall be suitable for operation on a 415V, 3 phases, 50Hz, 3-wire AC supply. All the internal power supply required for Starter unit and other accessories shall be derived from the above indicated power supply through control transformers.	
G.4.0	CONSTRUCTION:	
G.4.1	The actuator with bevel gear box shall be suitable for mounting directly on the valve. The actuator along with Bevel gear box shall be capable of giving the required torque, rpm and thrust. Indicate the adjustable range of torque and starting torque of actuator with bevel gear box in kgm/Nm for each offered models. The maximum thrust capability of the actuators with bevel gear box shall also be furnished. The actuators with bevel gear box shall be designed to take the full thrust. All Gears used shall be metallic. Fiber gears are not acceptable. Metallic gear trains used shall be self-locking type to prevent drift. Indicate the maximum stem acceptance diameter in the offer. Gear operators are to be supplied with input flanges to suit the keyed shaft of the Electrical actuator. Details of the input flange for each model shall be furnished. The gear casing shall be designed adequately to withstand shock and vibration of the pipeline. The design shall be compact and less weight and shall not cause any trouble during operation at sites. Bevel gear box Enclosure protection shall be min IP65. The gear operator shall have base suitable to take the thrust with ball/roller bearings. An Aluminum Bronze drive sleeve with a pilot bore shall be provided as a standard supply. The drive sleeve will be threaded by BHEL to suit the stem thread. The assembly of all gears, shafts etc... shall be done properly to have smooth operation without any noise. The flange for connecting the valve shall have dimensions as per BHEL Requirement indicated in the table All Gear operators shall have provision to accommodate raising spindle of the valve and the hole shall be properly covered with a removable lid. The Gear box shall be supplied with stem protection tube to accommodate larger spindle travel. The length of stem protection cover shall be as indicated in the table. All the above parts, i.e. the threaded portion of Gear box, removable lids and stem protection tubes shall be able to withstand the prolonged outdoor storage without getting rusted or damaged.	
G.4.2	Actuator with Bevel gear box mounting arrangement with dimensions, the thread connection of the Stem Protection Cover shall be clearly furnished along with the offer. The flange dimension shall be as indicated elsewhere in this specification.	
G.4.3	The dimension drawing of the blank adopter bush shall be furnished along with the offer.	

Clause. No	Specification requirement	Vendor confirmation/ comments/ deviation
G.4.4	Each actuator shall have a hand wheel fitted on it for manual operation in case of power failure. It shall be possible to fully open /close the valve with the hand wheel. The hand wheel shall be designed such that its engaging lever declutches automatically when the power supply to the motor is restored. The material of the hand wheel shall be either malleable iron or steel. The hand wheel-engaging lever shall give trouble free performance under repeated operations. Side mounted hand wheel with gear / Top mounted hand wheel can be offered. The hand wheel construction shall be strong enough to withstand the impacts of normal handling and storage of actuator without any damage. The hand wheel shall be able support the weight of the actuator, without any damage to actuator or hand wheel, when actuator is rested on the hand wheel.	
G.4.5	Actuators offered shall be with self-locking worm.	
G.5.0	TECHNICAL DATA:	
G.5.1	Desired output shaft speeds are given below for different torque ranges. Actual speeds of actuators offered shall be clearly indicated.	
G.5.2	Actuator + Bevel gearbox combination shall have provision to set the Torque value from 40% of the maximum Torque mentioned in the below table.	

Actuators with bevel gearbox - Technical requirements

Sl.No	Maximum Torque (Kg-m)	RPM (Approx)	Output flange details	Thrust (Kgf)	Stem Protection Cover in mm (unless otherwise specified)
1	200	14	177.8x298.5-8NOS M20	32000	400
2	400	9	215.9x355.6-8 NOS M24	45000	400
3	500	9	215.9x355.6-8 NOS M24	63000	400
4	800	8	215.9x355.6-8NOS M24	82000	400
5	1050	8	228.6x406.4-8NOS M30	120000	500
6	1400	6	228.6x406.4-8NOS M30	130000	500

Clause. No	Specification requirement	Vendor confirmation/ comments/ deviation
G.6.0	WEIGHT:	
G.6.1	Furnish weight of actuator with bevel gear box including all accessories.	
G.7.0	LUBRICANT:	
G.7.1	Oil plugs shall be provided for filling and draining separately.	
G.7.2	The gearbox of the actuator shall be oil filled or grease filled. The oil/grease must be suitable for operation for 80 Deg. above ambient temperature. Furnish detail of lubricant used with Indian oil Company's BPCL & HPCL's equivalent. The actuator shall have proper seals to prevent leakage of oil at all installation positions. The actuator construction shall be such that the oil/grease does not leak to other compartments or outside. Incase of any complaint of such leakage, the complaint shall be attended free of cost within one week and root cause of the problem shall be eliminated within one month.	
G.8.0	DIMENSIONAL CATALOGUES:	
G.8.1	Two copies of catalogues of the actuators with bevel gear box in English language describing the constructional details shall be sent along with the offer. The catalogues shall also provide over all dimensions of the actuators, bevel gear box, mounting flange, maximum spindle acceptance diameters and other details called for in the specification.	
G.9.0	O & M INSTRUCTION MANUALS:	
G.9.1	a) One copy of Operating and Maintenance Instruction Manual shall accompany each actuator with bevel gear box ordered. b) One set of Operating and Maintenance Instruction Manual of each type of actuator with bevel gear box both in Hard copy and in Soft copy in CD (in pdf format) shall be sent to us before dispatch of the actuator.	
A.0	ACCESSORIES	
A.1.0	TORQUE SWITCHES::	
A.1.1	Two numbers adjustable torque switches (one for open and one for close) each with 4 NO and 4 NC potential free contacts. The type of torque switch like rotary/cam shall be mentioned in the offer.	
A.1.2	The torque switches shall have accuracy of plus or minus 3% of set value.	
A.1.3	A scale shall be provided for each torque switch to set required torque. Each division shall indicate actual value of torque. The scale-setting knob shall have locking screw to avoid any setting disturbance at site due to line vibration.	
A.1.4	Actuators shall have provision for bypassing the torque switch during initial 5% opening of valves. Details for this must be indicated in the wiring diagram.	
A.1.5	The wiring diagram shall include details of changes to be done for making the actuator suitable for torque seating or position seating valves.	

Clause. No	Specification requirement	Vendor confirmation/ comments/ deviation
A.2.0	LIMIT SWITCHES:	
A.2.1	Two numbers of position limit switches (one for open and one for close) each with 2 NO and 2 NC potential free contacts. The type of limit switch like rotary/drum/cam type shall be mentioned in the offer.	
A.2.2	Two Auxiliary limit switches (one for open and one for close) each with 2 NO and 2 NC potential free contacts.	
A.2.3	Each limit switch shall be capable of being set to trip at any position independently between fully open and fully closed position.	
A.2.4	Limit switches and torque switches shall be weather proof suitable for damp atmospheres, and shall not cause any trouble during commissioning and operation.	
A.2.5	The torque and position limit switches shall be suitable for the following ratings, both 240 volts, AC, 5 amps and 220 volts DC, 0.5 amps. The insulation level between each set of contacts shall be minimum of 1.2KV for 1min.	
A.3.0	LOCAL POSITION INDICATORS:	
A.3.1	Each actuator shall have a local position indicator to indicate 0 to 100% of valve travel.	
A.3.2	The actuator with gearbox unit shall be suitable for operating different valve size with varying lifts. The actuators shall have adjustable gear for the local position indicator so that accurate indication of valve position can be obtained for all valve lifts by adjusting the gears. The gears selection chart for setting of local position indicator and mechanical transmitter for different valve lifts (output shaft revolutions) shall be furnished along with offer. Also one set of change gears shall be supplies along with each actuator.	
A.4.0	ANTI-CONDENSATION HEATER (SPACE HEATER):	
A.4.1	Each actuator shall have an anti-condensation heater in the limit switch compartment suitable for 240V AC 50 c/s single phase supply with thermostat for automatic switch ON/OFF Space heater based on the temperature inside limit switch compartment. The wattage of the heater shall be specified in the data sheet and wiring diagram shall represent the same.	
A.5.0	REMOTE POSITION TRANSMITTER:	
A.5.1	Open/Close actuator shall have two Nos. of resistance type position transmitter for remote indication. Rating of position transmitter 100ohms, 50 Volts, AC/DC. A suitable fixed dropping resistor must be put in series for limiting the power consumption.	
A.5.2	If enquiry item description contains " CLEPT/CEPT/CPT ", then inching duty actuators shall be considered. The same shall be offered with one no. of LVDT type (Non-contact type) electronic position transmitter, suitable for 24V DC with an output of 4-20mA and 2 wire system.	
M.0	MOTORS	
M.1.0	POWER SUPPLY:	

Clause No	Specification requirement	Vendor confirmation/ comments/ deviation
M.1.1	Motor shall be suitable for operation on a 415V, 3 phase, 3 wire ungrounded supply system.	
M.1.2	Motor shall operate without any trouble under the following conditions.	
	a. If the voltage varies within plus or minus 10% of the rated value of 415 Volts.	
	b. If the frequency of the power source varies within plus or minus 5% of 50 c/s.	
	c. If the voltage and frequency of the source vary simultaneously and the sum of the absolute percentage values in variation does not exceed 10%.	
M.2.0	CONSTRUCTION:	
M.2.1	Motor shall be totally enclosed with min IP 68 or better weatherproof enclosure and shall be suitable for outdoor installation without canopy. All electrical equipment, accessories and wiring shall be provided with tropical finish to prevent fungus growth. In case of any water leakage due to enclosure failure it shall be attended free of cost within one week and root cause of the problem shall be eliminated within one month	
M.2.2	Motor shall be conforming to IEC 60034 or any other equivalent international standard for all requirements unless otherwise specified herein.	
M.2.3	The enclosures shall be treated and prepared for painting with suitable painting system for withstanding 500Hrs of salt spray as per ASTM B-117/ ISO9227 standard. Motor shall be painted with corrosion proof epoxy resin paint. Paint shade shall be RAL 7032	
M.3.0	INSULATION:	
M.3.1	Motor shall have class F non-hygroscopic insulation with tropicalisation suitable for polluted dusty and corrosion atmospheres of relative humidity 100%. Motor shall be designed for an ambient temp of 70 degree C. However, the temperature rise of the motor winding shall be limited to the maximum temperature allowed for class 'B' insulation. It shall also be possible to rewind the motor in case the windings and insulation get burnt out.	
M.4.0	RATING:	
M.4.1	For ON/OFF Motors shall be S2-15 min. rating. This shall not be less than the highest of the following: 1) Fifteen minutes. 2) As required for three successive open/close operations	
	For Inching service, 150 starts per hour shall be considered.	
M.5.0	STARTING:	
M.5.1	Motor shall be suitable for direct on-line starting.	

M.5.2	Starting current shall be limited to 6 times the full load current.	
Clause No	Specification requirement	Vendor confirmation/ comments/ deviation
M.5.3	Motor shall be capable of a. Starting at 85% of rated voltage. b. Running at 80% of rated voltage at rated torque for a period of 5 minutes c. Running at 85% of rated voltage at 33% excess rated torque for a period of 5 minutes d. The torque at reduced supply voltage shall be mentioned for 75% voltage, 80% voltage, 85% voltage & 90% voltage.	
M.6.0	BEARINGS:	
M.6.1	Bearing shall be of double shielded, grease lubricated antifriction type. The anticipated bearing life shall be indicated for all models.	
M.7.0	EARTHING TERMINALS:	
M.7.1	Two earthing terminals shall be provided on either side of the motor.	
M.8.0	MOTOR DATA:	
M.8.1	One set of hard and soft copies of motor data sheets for each type of actuators ordered shall be furnished as per format furnished.	
M.9.0	TESTS:	
M.9.1	Tests shall be carried out as per approved QP.	
C.0	CONTROLS	
C.1.0	INTERNAL WIRING:	
C.1.1	Internal wiring diagram shall be neatly pasted on cover of terminal box.	
C.1.2	Internal wiring shall be done with 1.5 sq.mm PVC insulated copper wires. Ferrules should be provided on both ends of the wire for easy identification.	
C.2.0	FEATURES APPLICABLE TO INTEGRAL STARTER	
C.2.1	The actuators shall have integral starters. Control supply shall be derived with step down transformer from 415V, 3PH incoming supply. Necessary primary and secondary fuses shall be provided. All the PCBs shall be protected against moisture by suitable coating and treatment. In case of failure of PCBs due to moisture entry, it shall be attended free of cost within one week and root cause of the problem shall be eliminated within one month	
C.2.2	Automatic phase correction facility and single phasing prevention shall be available.	
C.2.3	All actuators shall be configured for both safety functions SIL Move to limit and SIL to Stayput. i.e Safe OPENING/CLOSING and Safe ESD (i.e STOP)	
C.2.4	Lockable Selector switch for LOCAL-OFF-REMOTE selection. Push buttons OPEN, STOP, CLOSE (for local operation) shall be provided.	
C.2.5	It should also be possible to reverse the direction of travel for inching valves (in LOCAL and REMOTE) without giving stop command.	

C.2.6	Lamp Indication for full open, full close and in-travel positions shall Be provided.	
Clause. No	Specification requirement	Vendor confirmation/ comments/ deviation
C.2.7	Electrically and mechanically interlocked contactors shall be provided for forward and reverse operation. Contactor rating shall be sufficient to withstand the extreme conditions like valve jamming and instantaneous reversal of motor.	
C.2.8	Potential free contacts for LOCAL-OFF- REMOTE positions shall be wired to terminals and available for customer connections.	
C.2.9	Open/Close command termination logic with position and torque set points shall be suitably built in the PCB inside the actuator.	
C.2.10	All actuator settings indicated below shall be possible without opening the actuator. a) Valve seating by torque (close) or limit (close) shall be available. b) Inching (non self-retaining) or non-inching (self-retaining) for remote command and local mode shall be field configurable.	
C.2.11	Provision shall be there for bypassing the torque switch during initial 5% opening and closing of valves. Details for this must be indicated in the wiring diagram. This shall be done through electronic circuit or through one 'NC' contact of 'limit switch.	
C.2.12	24V Power supply for CPT/CEPT / CLEPT shall be derived internally.	
C.2.13	Thermostats shall be embedded in motor winding. thermostats shall be connected in control circuit to trip actuator in case of overload.	
C.2.14	The following status annunciation shall be made available locally (integral to actuator) a) Actuator running in OPEN b) Actuator running in CLOSE c) Internal 24V DC Control voltage healthy d) 24V DC availability for customers use healthy.	
C.2.15	The following individual fault annunciation shall be made available locally (integral to Actuator) for easy trouble shooting a) Open Torque sensor acted b) Close Torque sensor acted c) Thermostat trip d) Motor single phasing e) Wrong phase sequence protection acted	
C.2.16	24V Power supply for Contact less EPT shall be derived internally.	

Clause No	Specification requirement	Vendor confirmation/ comments/ deviation
C.2.17	<i>Actuators shall be Non-Intrusive type electric actuators. The interface of these actuators with DDCMIS shall be of two types viz. with Hardwired interface and with Fieldbus interface.</i> COMMON REQUIREMENTS FOR NON INTRUSIVE ELECTRIC ACTUATORS a) Actuator shall be suitable for remote operation by potential free contacts for Safe open / safe close and safe stop, the necessary 24V DC power supply shall be derived internally. Also It shall be possible to energise the interposing relays provided (with coil burden $\leq 2.5\text{VA}$, one for open and one for close) to initiate opening and closing by 24V DC signal from the external control system, accordingly suitable isolated interface in the actuator shall be provided. b) Change-over contact for SIL collective failure signal and SIL Ready signal/ monitor relay signal c) Based on the input Demand signal, actuator should be in Stay put (or) move to Open/close position (ie. Both safety functions SIL Move to limit and SIL to Stayput to be considered) d) The vendor shall provide all necessary configuration files/application like GSD (General Station description), EDD (Electronic Device Description), DTM (Device Type Manager) and any other file for interface of actuator with DDCMIS e) SIL CERTIFICATION: All actuators shall be certified for SIL 2 or better. SPECIFIC REQUIREMENTS FOR NON INTRUSIVE HARDWIRED ACTUATORS INTERFACES: f) For ON-OFF and INCHING type actuators interface with the control system shall be through hardwired signal only. g) Open/Close command, open/ close status and disturbance monitoring signal (common contact for Overload, Thermostat, control supply failure, L/R selector switch at local & other protections operated) shall be provided hardwired. h) The actuator shall be able to accept open/close command at 24V DC with max. 2.5VA load from control system. Accordingly, suitable isolated interface in the actuator shall be provided. i) Open/close command termination logic shall be suitably built inside actuator. SPECIFIC REQUIREMENTS FOR NON INTRUSIVE FIELDBUS ACTUATORS INTERFACES: j) Open/ close commands, open/ close feedback status, disturbance signal etc. shall be available to the Control System through the fieldbus network along with diagnostics. The detailed diagnostics including the actuator operating data shall be available to the DDCMIS through the fieldbus network.	

	k) All actuators shall be Profibus compatible based on finalized protocol of DDCMIS. Actuator shall have two (redundant) Profibus DP ports for connecting the redundant Profibus DP cables. That is if one profibus cable is cut or not working/ not available, then complete actuator functionality shall be available through the second redundant cable without any manual intervention. Profibus DP Actuator should comply with IEC 61158, Twisted pair with round steel wired armour (SWA), Type A fieldbus cable complying to 61158. l) Open/close command termination logic shall be suitably built inside actuator. m) The vendor has to furnish Profibus Certification of the offered product from accredited Profibus User Organization (PI) Test Lab (PITL)	
C.2.18	Thermal over load relay shall be provided in addition to thermostats embedded in motor winding. Overload relay and thermostats shall be connected in control circuit to trip actuator incase of overload. OLR set value shall be mentioned in wiring diagram/ Data sheets .	
C.2.19	Vendor has to consider one no. hand held programming tool for 7 nos. of actuators in his package (Eg. if the total package qty is 61 nos, then vendor has to consider 7nos of configurator as min.), if the same is applicable for configuring the supplied actuator.	
Clause. No	Specification requirement	Vendor confirmation/ comments/ deviation
C.2.20	A common potential free contact (monitoring relay) shall be available to annunciate the following faults. a) Thermostat trip b) OLR trip c) Valve jammed in mid-travel. d) Motor single phasing. e) Control supply failure. f) Local stop or local/remote selector switch in local mode.	
C.2.21	The following status annunciation shall be made available locally (integral to actuator) a) Actuator running in OPEN b) Actuator running in CLOSE c) Internal 24VDC Control voltage healthy d) 24VDC availability for customers use healthy.	
C.2.22	The following individual fault annunciation shall be made available locally (integral to Actuator) for easy trouble shooting a) Open Torque sensor acted b) Close Torque sensor acted c) Thermostat trip d) Thermal overload relay trip e) Motor single phasing f) Wrong phase sequence protection acted	
C.2.23	BLINKER RELAY: Blinker relay contact for remote indication of 'actuator running' is to be provided as a standard part of integral starter actuator.	

C.2.24	In the event of voltage dips/ power outage, status of MOVs (OPEN/ CLOSE indication) for remote annunciation shall not undergo any change. The wiring for all MOVs feedback controls shall be fail safe type. Any backup for power supply & hardware required for achieving the same shall be provided by vendor within the actuator. No other power supply other than 415V+/-10%, three phase, 50Hz+/-3% incoming supply to each of MOV Actuator shall be provided.	
C.3.0	TERMINAL BOX:	
C.3.1	All terminals of position limit switches, torque limit switches, space heaters and position transmitters shall be brought to a common terminal board. The terminals shall be clip-on type/screw type with sufficient insulation between 2 adjacent terminals. All terminals must be suitable for 2 nos. of 2.5 sq.mm wires.	
C.3.2	Minimum 10 numbers of terminals shall be available in the terminal board as spare terminals.	
Clause. No	Specification requirement	Vendor confirmation/ comments/ deviation
C.3.3	Terminal box of actuator shall be weather proof. One Number PVC insulated armoured copper / aluminium conductor power cable (Exact Cable size will be furnished after ordering). Motor terminals shall be of stud type, screw type and press fit type depending on the power rating. Terminal box shall be fitted with a removable front cover plate. Termination of Control Cable :- 9 Pin plug & sockets (2 Nos. wired + 1 No. spare as loose supply) shall be provided to suit 4 pair 0.5 sq.mm. Copper overall shielded (16 mm OD), instrumentation cable. The socket shall be fixed on the terminal board and wired to the terminal blocks as per the wiring drawing.	
C.3.4	Default setting of torque switch, dial indicator on and torque/limit closing to be included in the documents.	
C.4.0	CABLE GLAND:	
C.4.1	Actuators are to be provided as a standard with one cable gland for power and 3 cable glands for control (Exact Cable OD will be furnished after ordering). All the cable glands shall be of double compression type and made of Ni plated Brass material. Un used cable entries shall be plugged with Ni plated Brass plugs with suitable sealing (like 'o' ring) to ensure IP68 or better protection.	
C.4.2	Preferably all the cable glands shall be provided on one direction (face) only. Wherever this is not technically feasible, the cable gland on the second side shall be provided with necessary elbows, so that all glands will be facing at one side.	
S.0	SPARES	
S.1.0	Supplier shall specify a list of recommended spares for 2/5 years trouble free operation. An exploded view of the actuator with bevel gear box shall be furnished with part numbers for identifying the spares.	

Clause. No	Specification requirement	Vendor confirmation/ comments/ deviation
D.0	DOCUMENTS	
D.1.0	Furnish the following documents along with offer & after ordering:	
	a. Outline dimension of assembled motor with gear box . - GA drawings for all models (Motor with gearbox) including dismantling clearances and material specification of critical components. - The dimension drawing of the drive sleeve - Data sheet for all models, along with weight of the actuator - Dimensional catalogue with maximum spindle acceptance details - Wiring diagram for all models. - Gear selection chart for setting of local position indicator	
	b. Outline dimension of actuator with gear box.	
	c. Dimensional drawing of terminal showing the method of terminating incoming cables.	
	d. General arrangement drawing of actuator with gear box consisting following as minimum	
	e. Identification of critical component with its material composition.	
	f. Mounting flange dimension	
	g. Hand wheel dimensions	
	h. Actuator cover removal clearances	
	i. Weight of actuator + gear box with and without integral starter	
	j. Stem protection cover length, thread size and type	
	k. Double compression cable gland & plugs	
	l. Separate drawing for details of cable gland cross section, min/ max. cable OD that can be accommodated, critical dimension etc.	
	m. Quality plan	
	n. Type test certificates	
	o. Default settings of torque, dial indicator and torque/limit closing for all models.	

Clause. No	Specification requirement	Vendor confirmation / comments / deviation
T.0	TEST REQUIREMENTS FOR ACTUATORS	
T.1.0	ROUTINE TEST:	
T.1.1	Dimensions: Overall and mounting	
T.1.2	Details of painting as per specification and vendor practice: Anticorrosiveness Epoxy.	
	i. Shade.	
	ii. Finish	
	iii. Paint thickness	
T.1.3.	Manual operation through hand wheel.	
T.1.4.	Testing of position and torque limit Sensors for accuracy and repeatability.	
T.1.5.	Hand-Auto switching function.	
T.1.6	For motors, all routine tests as called in IEC- 60034 from motor manufacturer.	
T.1.7	Output shaft speed and torque of actuator and corresponding current.	
T.1.8	Stall current and stall torque for the actuator assembly.	
T.1.9	a. Position indicator and transmitter: Calibration check for accuracy, linearity and repeatability.	
	b. Functional test for electronic position transmitter (If applicable).	
T.1.10	Leakage test for gear case (visual).	
T.1.11	HV test at 1.6 KV (80% of 2 KV) for the assembled actuator.	
T.1.12	Operation of actuator under variation in supply voltage (plus or minus 10%) for verifying rated torque and speed.	
T.1.13	Checking of wiring as per approved wiring diagram	
T.1.14	The following tests are applicable for integral starter actuators	
	a. Functional test for local / remote / off selection	
	b. Open/close/stop operation in local and remote mode.	
	c. OLR tripping	
	d. Functional test, temperature raise test and burn-in test on PCB	
T.2.0	TYPE TEST certificates shall be provided for the following tests.	
T.2.1.	Type test for motor as per IEC- 60034	
T.2.2.	Noise and vibration test for total assembly IS: 4729/BS 4999.	
T.2.3.	Temperature rise test during:	
	a. Operation of actuator at 90% voltage.	
	b. Operation of actuator at 50-degree C ambient.	
T.2.4.	Operation with variation in frequency (plus or minus 5%) for verifying rated torque and speed.	
T.2.5.	Enclosure protection for the total assembly.	
T.2.6.	Endurance test for actuator.	
T.2.7.	Endurance test for limit sensors (if applicable)	
T.2.8.	Damp heat cycle test as per IS:9000/IEC 68-30.	
T.2.9.	Following test are applicable for integral starter actuators	
	a. Type test on bare PCB	
	b. Life cycle test	

Clause. No	Specification requirement	Vendor confirmation/ comments/ deviation
T.3.0.	The gear operator shall be tested to the design requirement of torque and thrust and type test certificates shall be furnished. The mechanical efficiency shall not be less than 95%.	
T.3.1.	Certificate for routine test.	
T.3.2.	Routine and type test reports for motors.	
T.3.3.	Type test report for all tests listed under 'T.2.0'	
T.3.4.	TC for endurance test for limit sensor and torque sensor (if applicable).	
T.3.5	The gear operator shall be tested to the design requirement of torque and thrust and type test certificates shall be furnished. The mechanical efficiency shall not be less than 95%.	
N.1.0	NOTES:	
N.1.1.	The supplier shall submit quality plan covering quality checks carried out in different stages of procurement process, manufacturing assembly, testing and final inspection stage. These quality plans shall be approved by BHEL.	
N.1.2.	All testing facilities shall be arranged by the vendor, at his works before calling BHEL / TPI representative for inspection.	
N.1.3.	Approved drgs., PO specification and relevant standards if any shall be made available during testing / inspection.	
N.1.4.	All measuring and testing instruments shall be periodically calibrated from National test house and certificates made available during inspection.	
N.1.5	All relevant GA drawings, data sheets & wiring diagrams shall be submitted as controlled copy and approval shall be obtained from BHEL. All supply shall be as per these documents.	
N.1.6	<u>Nameplate:</u> Each motorized valve actuator with gear box shall be provided with a stainless steel nameplate furnishing the following details as minimum, attached firmly to it at a place convenient for reading: <u>Actuator:</u> a) Actuator tag number as per data sheet b) Motor kW rating, motor short time rating, motor supply voltage, nominal motor phase current, auxiliary switch rating c) Maximum torque setting c) Actuator enclosure type, lubricant type d) Actuator type, wiring diagram number/ catalogue number, actuator serial number. <u>Gearbox:</u> Make, Model Number, Serial Number, Output Torque, Permissible Thrust, Gear Ratio.	
N 1.7	<i>Packing & Transport: Refer ANNEXURE-A</i>	

ANNEXURE-A : Instruction for packing of Actuator/ Bevel Gearboxes

Packing box:

1.1) The Actuator/Gearbox shall be supplied packed in any seasoned wood or plywood are wooden box as per relevant international standard. Sea worthy packing is envisaged for international shipments.

1.2) The box shall have inner lining of polythene sheet (minimum of 250G polythene sheet)/waxed paper/water proof paper or similar protection against water entry.

1.3) Use fillers like thermocol / loose fill or air-cellular cushioning material such as Bubble Wrap to fill void spaces and prevent movement inside the box during shipping.

Actuator/Gearbox Covering:

1.4) Further the Actuator/Gearbox shall be completely covered with a water-proof barrier highly resistance to the passage of water-vapour - like thick polythene bag (Minimum of 500G thickness). Sharp corners, edges and projects of the Actuator/Gearbox should be covered to prevent abrasion or puncture of the water proof barrier with anti-abrasive material like felt. Extra length and projections of the polythene bags are to be wrapped and secured by strips of self-adhesive tapes.

1.5) After opening the box, the water-proof barrier shall be intact and it is intended to store Actuator/Gearbox for long time with this water-proof barrier.

1.6) Suitable desiccants shall be provided in to the sealed water proof barrier. The desiccant shall be in small bags and disposed uniformly. They shall be secured in position to minimize chances of desiccant dust escaping. The amount of total desiccant shall be such to limit the relative humidity within the cover to a maximum value of 50 percent – for a long time of storage.

1.7) The equipment's covered with a polythene sheet shall be kept inside the box, followed by coir, wooden bottoms, loose fill or air-cellular cushioning material such as Bubble Wrap to fill void spaces, thermocol, etc. to prevent vibration effect during loading, transportation, etc.

1.8) On all sides of the inner case, black polythene sheet shall be nailed.

1.9) Loose items of the equipment if any shall be packed separately.

Marking on the box:

2.1) All spares shall be packed separately in boxes marked SPARE. Spare components are also to be covered separately with water-proof packing.

2.2) Actuator/Gearbox model and material code shall be prominently marked on the box.

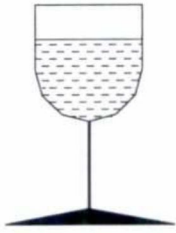
2.3) Special precaution notations such as 'Fragile', 'This side up', 'centre of gravity', 'weight', 'Owner's particulars', 'Purchase Order No.', 'Order item No.' etc. shall be clearly marked on the package together with other details as per purchase order.

2.4) After completing the packing, Stencil marking, as per dispatch instructions and symbol marking as per Annexure — I shall be made.

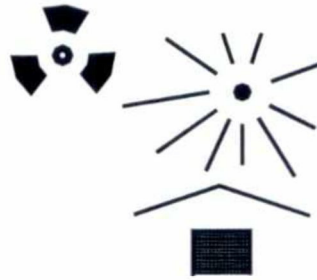
Packing slip:

A copy of the packing slip, kept in a polythene cover shall be kept inside the box. Another copy of the packing slip, kept in a polythene cover shall be kept outside the box and covered with a metallic plate to the case.

ANNEXURE — 1



FRAGILE, HANDLE WITH CARE



PROTECT FROM HEAT AND RADIOACTIVE SOURCES



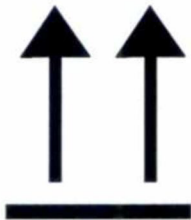
USE NO HOOKS

NOTE: The design of heavy goods packages cannot always resist top lifting by grabhooks.



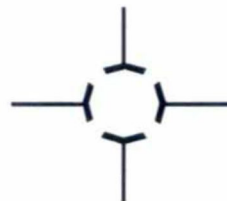
KEEP DRY

NOTE: Not all cases have waterproof internal liners: plywood used in the construction may not have a waterproof glue line.



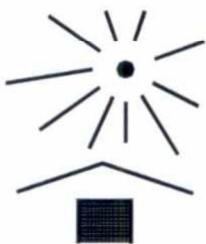
THIS WAY UP

NOTE: Certain designs of small cases make it difficult to distinguish top from bottom.



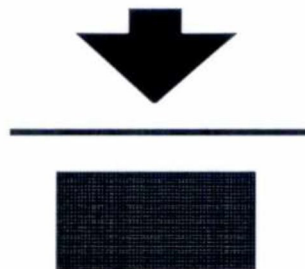
CENTRE OF GRAVITY

NOTE: This should be stencilled as a minimum on the two longest case sides (this information will normally be supplied by the manufacturer of the item(s) packed).



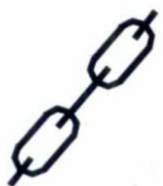
KEEP AWAY FROM HEAT

... kg max

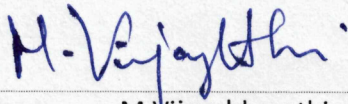
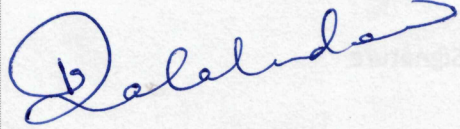


STACKING LIMITATION

NOTE: The maximum load in kilograms should be marked above the arrow.



INTERNATIONAL "SLING HERE" SYMBOL

Signature		
Name	M.Vijayabharathi	K.Jalaludeen
Designation	Engineer	Manager
Date	06 July 2023	06 July 2023
Action	Prepared & Checked By	Approved By

Bharat Heavy Electricals Limited

HIGH PRESSURE BOILER PLANT , TIRUCHIRAPPALLI 620 014.

TECHNICAL DELIVERY CONDITIONS

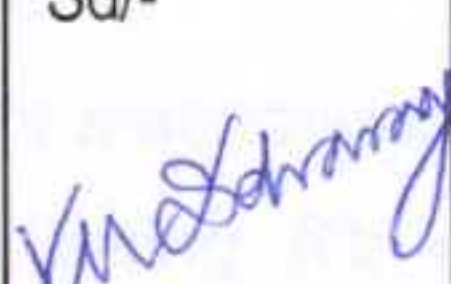
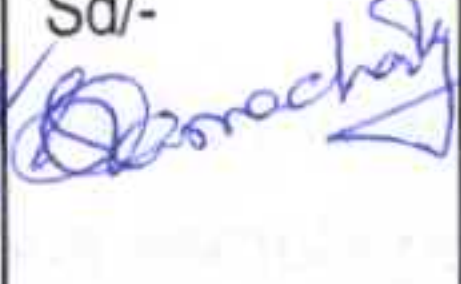
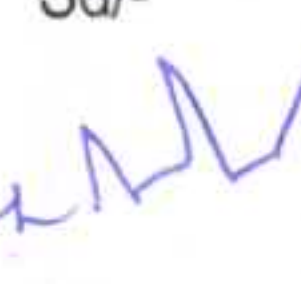
FOR SUB - DELIVERY COMPONENTS OF

CONTROLS AND INSTRUMENTATION

TDC : TCI : 129 / REV 05

PAGE 01 OF 03

CRIMPING LUGS

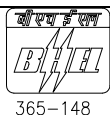
Rev. No.	DATE	DESCRIPTION	PREPARED	REVIEWED	APPROVED	
					ENGG	QAC
01,02	----	General Revisions	Sd/-	Sd/-	Sd/-	Sd/-
03	09.07.93	Page Number added	Sd/-	Sd/-	Sd/-	Sd/-
04		General Revision	Sd/-	Sd/-	Sd/-	Sd/-
05	07-02-04	Revised as per revisit				

CL NO.	CHARACTERISTICS	REQUIREMENT	VENDOR COMPLIANCE (Refer Note : 2)
1.0	<u>SITE CONDITIONS</u>		
1.1	Altitude above mean sea level	550 m	
1.2	Ambient temperature condition	50° C	
1.3	Relative humidity	100 %	
1.4	Atmosphere	Tropical , Dusty, salty, corrosive & highly polluted	
2.0	<u>GENERAL</u>		
2.1	Reference standard	IS 1897 (For copper)	
2.2	Application	For terminating wires/cores of cables to terminal blocks.	
2.3	Type	Insulated type (Ring type, Round Pin type, Flat Pin type, Inline connector)	
2.4	Material of lug	Pure, high grade electrolytic copper as per IS 1897	
2.5	Finish	Lug to be Electro tinned	
2.6	Type of conductor to which crimped	Solid copper conductor/Stranded copper conductor	
2.7	Type of socket of the lug	Closed type, with silver brazing to ensure perfect contact. Serration on inside for ensuring proper grip of conductor.	
2.8	Material of insulation	PVC with metal reinforcement	
2.9	Insulation voltage grade	1100 Volts	
2.10	Model/Size	As per Purchase Enquiry	
3.0	<u>INSPECTION & TESTING</u>	i) Dimensions ii) Check for inscriptions. Make/model. Persulphate	

CL NO.	CHARACTERISTICS	REQUIREMENT	VENDOR COMPLIANCE (Refer Note : 2)
4.0	<u>PACKING</u>	test for tinning. (On one sample per Purchase order) iii) Material certificate (typical) As per Packing Procedure QA:CI :STD:PR:04 (Latest Revision)	

NOTE:

1. Refer current valid list for revision status of Quality Plan, Drawing No. & Packing Procedure.
2. In Vendor Compliance column - vendor to indicate 'YES', 'NO' or 'NOT APPLICABLE'.



VALVES ENGINEERING AND R&D
TECHNICAL SPECIFICATION FOR SUBDELIVERY
COMPONENTS OF SOOT BLOWERS

TSB:068

Rev. 06

SHEET NO. 1 of 2

PUSH BUTTON

1.0 Component : Push button : Green

Push button : Red

1.1 Material Code:

96 353 347 0000 PUSH BUTTON GREEN

96 353 347 0100 PUSH BTN OPRTOR C&H

96 353 347 0200 GREEN PUSH BTN

96 353 347 0300 PUSH BUTTON GREEN-2NO+ 2NC

96 353 348 0000 PUSH BUTTON RED

96 353 348 0100 PUSH BTN OPRETR

96 353 348 0200 PUSH BTN ONLY

96 353 348 0400 PUSH BUTTON-RED LOCKABLE STAY PUT TYPE

96 353 348 0500 PB RED/MUSHROOM/LATCHED

96 353 348 0600 PUSH BUTTON RED-2NO+ 2NC

1.2 Application : Push button green is used to start the wall de-slagger and push button red is used to retract the wall de-slagger.

1.3 Quantity : 1 No. each / Wall blower

2.0 Specification :

2.1 Push button shall be of momentary contact push to actuate type, rated at 6 A at 415V AC.

2.2 Push button shall be fitted with self reset 1NO + 1NC / 2NO + 2NC Contacts as applicable.

2.3 Push button shall be provided with integrally mounted legend plate. The legend plate shall be white anodized aluminium with black lettering.

2.4 The green push button shall be provided with 'START' legend plate and the red push button with 'RETRACT' legend plate.

Rev:06 Dt.15.05.2017	Matl. Code 963533470100, 963533470200, 963533480100, 963533480200, 963533480600 added.	
Prepared By(J SANKAR)	Checked & Approved By (HIRENDRA RAUT)	



VALVES ENGINEERING AND R&D
TECHNICAL SPECIFICATION FOR SUBDELIVERY
COMPONENTS OF SOOT BLOWERS

TSB:068

Rev. 06

SHEET NO. 2 of 2

- 2.5 Complete oil tightness shall be ensured in the actuator housing.
- 2.6 The push button shall be shrouded type,
- 2.7 The push button shall be suitable for an ambient temperature of 65°C.
- 2.8 The supplier shall enclose along with offer 3 copies of technical leaflet.
- 2.9 Push button shall be suitable for Ø30.5 mm hole.
- 3.0 Approx. weight : 0.2 kg/push button
- 4.0 Packing : To be packed in weather proof card board boxes and dispatched.
- 5.0 Internal inspection:
1. Limit switch type
 2. Electrical actuator
 3. Mechanical soundness.

Rev:06 Dt.15.05.2017

Matl. Code 963533470100, 963533470200, 963533480100, 963533480200,
963533480600 added.

Prepared By(J SANKAR)

Checked & Approved By (HIRENDRA RAUT)



**PRODUCT ENGINEERING / V & SB
TECHNICAL DELIVERY CONDITIONS FOR
SUBDELIVERY COMPONENTS OF SOOT BLOWERS**

TSB : 005

Rev. 03

SHEET No. 01 of 01

CABLE SINGLE CORE 1.5 mm²

- 1.0 Component : Cable Single core 1.5 mm²
- 1.1 Material Code : 330021620000
- 1.2 Application : Used in Wall Deslagger and Rotary Blower.
- 2.0 Specification :
- 2.1 Conductor : Single conductor (1 Core)
- 2.2 Area of conductor : 1.5 mm² Multi strand.
- 2.3 Material of conductor : (7 strands) Tinned copper.
- 2.4 Insulation : PVC unsheathed.
- 2.5 Voltage rating : 600/1100V
- 2.6 Color of sheathing : Red
- 2.7 In general the method of manufacture should confirm to IS 694
- 3.0 Inspection Test certificate:
- 3.1 Inspection shall be carried out by BHEL Inspector at BHEL Works (A)
- 3.2 Testing should be done as per IS 694 at supplier's works and test certificates shall be supplied.
- 4.0 Quantity : 5 meters per wall deslagger and one meter per Rotary blower.
- 5.0 Spares : 5% extra may be ordered to cater the manufacturing reserve.
- 6.0 Packaging : The wire should be wound on wooden drum with suitable end plugs
and despatched in wooden boxes.
- 7.0 Storing : To be stored under covered area.
- 8.0 Approximate weight : 0.03 kg per meter.
- (A) For Internal Use.
- i. Check for Area, No. of Strands, Color.
- ii. Check whether the supplier has provided the test certificate.

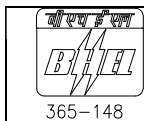
Rev:03 Dt.03/04/2006.

CONVERTED AS SOFT COPY.

Prepared (K.SRIDHARAN)

DATE:
17/08/2006

Approved (S.NATARAJAN)



PRODUCT ENGINEERING / V & SB
TECHNICAL SPECIFICATION FOR SUBDELIVERY
COMPONENTS OF SOOT BLOWERS

TSB:007

Rev. 05

SHEET NO. 1 of 1

3C X 2.5 mm² PVC INSULATED PVC SHEATHED UNARMoured CABLE

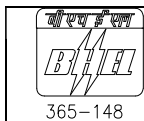
1. Component : 3 Core 2.5mm² PVC Insulated PVC Sheathed Unarmoured Flexible cable (chord).
2. Material code : 33 002 146 0000
3. Application : For wiring rotary motor to Limit switch in Wall Blower.
4. Specification :
 - 4.1. No. of cores : 3
 - 4.2. Area of Conductor : 2.5 mm² (36 strands / 0.3 mm or 80 / 0.2mm).
 - 4.3. Conductor Construction : Multi Strand Annealed Tinned Copper (As per IS-8130).
 - 4.4. Insulation : PVC (As per IS-5831).
 - 4.5. Voltage rating : 600/1100V.
 - 4.6. Sheathing : PVC Inner & Outer.
 - 4.7. Core assembly : 3 conductors insulation coloured as Red, Yellow and Blue.
 - 4.8. Overall diameter of the cable should be 12 ± 1 mm.
 - 4.9. In general, the construction /manufacture should conform to IS-1554 part 1.
5. Inspection, Testing and Certificate:
 - 5.1 Testing & Test certificate shall be as per IS-1554 part 1.
 - 5.2 Inspection shall be done by BHEL inspector for the following:
 - i. To check for dimension of cable OD. Colour codes, number of strands and core sizes.
 - ii. Check whether the supplier has provided test certificate.
6. Packing: The cables are to be wound on a wooden drum with suitable protection on the ends and must be packed & supplied in weather proof packing.
7. Storage : It shall be stored under covered roof and exposing to atmosphere will damage the material.
8. Approximate weight : 0.25 kg / meter.

Rev:05 Dt.30.01.2020

Specification updated.

Prepared By(J SANKAR)

Approved By (GURPREET SINGH)



**PRODUCT ENGINEERING / V & SB
TECHNICAL SPECIFICATION FOR SUBDELIVERY
COMPONENTS OF SOOT BLOWERS**

TSB:044

Rev. 07

SHEET NO. 1 of 1

3C X 2.5 mm² PVC INSULATED PVC SHEATHED ARMoured CABLE

SL. No.	Description	Requirements
1.0	Component	3 core 2.5 mm ² PVC insulated PVC sheathed armoured cable.
1.1	Material Code	96 353 328 0000 96 353 010 0000 - FRLS-HRPVC CABLE (3CX2.5 mm ²)
1.2	Application	For wiring Terminal box to Limit Switch and Potentiometer of Temp. Probe & Long Retractable SB.
2.0	Specification	
2.1	Number of cores	3
2.2	Area of conductor	2.5 mm ² (36 strands / 0.3mm)
2.3	Material of conductor	Multi stranded Annealed tinned copper (As per IS 8130).
2.4	Insulation, sheathing & Armouring	PVC insulated with armoured around the insulation of 3 cores and also with outer PVC sheathing to cable OD of 14.5 mm. Armour wire diameter should be 0.8 to 0.9 mm.
2.5	Voltage rating	600/1100 V
2.6	Core assembly	3 conductors insulation coloured as Red, Yellow and Blue.
2.7	Cable size	The overall diameter of the cable should be 14.5 ± 1 mm In general the construction/ manufacture should conform to IS 1554: Part 1
3.0	Testing and Inspection	
		a) Testing should be as per IS 1554: Part 1: and a test certificate is to be supplied. b) Inspection shall be done by BHEL inspector for the following: (i) To check for dimension of cable OD. Colour codes, number of strands and core sizes. (ii) Check whether the supplier has provided test certificate.
4.0	Packaging	Cables are to be wound on a wooden drum with suitable protection on the ends and must be packed and supplied in weather proof packing.
5.0	Quantity	As per Purchase order.
6.0	Spare requirements	10% of the total quantity required for manufacturing reserve.
7.0	Storage	It shall be stored under covered area. Exposing to atmosphere will damage the material.
8.0	Approximate Weight	0.45 kg/meter.

Rev:07 Dt.30.01.2020

Specification updated.

Prepared By(J SANKAR)

Approved By (GURPREET SINGH)