2X250 MW, GHTP STAGE-II, LEHERA MOHABAT UNIT 3 & 4

VOLUME: IIB & III.

TECHNICAL SPECIFICATIONS
FOR
SITE VISIT, SUPPLY OF MISSING ITEMS AND ERECTION AND REPLACEMENT OF DEFECTIVE ITEMS & COMMISSIONING OF COOLING WATER, RAW WATER AND PORTABLE WATER CHLORINATION PLANT.

SPECIFICATION NO.: PE-TS-266-174-A001

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
PPEI, NOIDA, INDIA.

CONTENTS

VOLUME-IIB & III

SECTION - A

(SCOPE OF ENQUIRY)

1.0 SCOPE:

This specification is intended to cover design, engineering, manufacturing, painting, inspection & testing at manufacturer's works, complete with all accessories including start up and commissioning spares, packing, shipment and delivery to Power Station Site for missing items and replacement of defective item in the existing partially supplied/ partially erected chlorination plant. In addition, the bidder's scope shall include erection (except already erected) and commissioning, unloading, storage and handling at site, site testing, trial run, obtaining clearance from Explosive department demonstration tests and handing over to customer the complete CHLORINATION PLANT for 2X250 MW, GHTP STAGE-II, LEHERA MOHABAT UNIT 3 & 4. The scope of supply shall fully cover the requirement of the Design Criteria and Technical Specification of this specification. Also, bidder to include all necessary items like control cables, power cable, screened cables, Cable trays, accessories & cable trays, Cable glands and lugs, Conduit and conduit etc. as required for electrical and control systems to make the system complete in totality. Any modification required in the already supplied equipment shall be in bidder scope.

Bidders to please note that originally the plant was supplied by M/s Banaco Mumbai. The plant was left incomplete and abandoned. As per our site feedback the as on date material not received along with technical details is as listed in ANNEXURE-A. Bidder to note that items which needs to be erected /commissioned as per ANNEXURE-A shall be carried out by the vendor. Any additional item required for the completion of the package shall be in bidder's scope. Bidder to visit the site for actual assessment of the scope of the work.

Bidder shall ensure that the additional items supplied by the bidder should be interchangeable / compatible with the chlorination already supplied by M/s Banaco and same shall be able to integrate / hook with the existing system. The bidder shall carry out required rectification, erection, commissioning and hand over the plant to customer in running condition. The plant to be commissioned in totality, including the control system, electrical system & mechanical system for successful run of the plant.

It is not the intent to specify all the details of the design & manufacture. However, the equipment shall conform in all respect to high standard of design, engineering & workmanship and shall be capable of performing the required duties in a manner acceptable to Engineer / Purchaser, who will interpret the meaning of drawing & the specification & shall be entitled to reject any work or material, which is not in full accordance herewith.

In case of any deviation / clarification, the Bidder shall indicate the same clause by clause in the deviation / clarification schedule. In the absence of the same it will be construed that the bid conform strictly to the specification.

In case of any data/requirement stipulated in the drawing but not in the specification and vise-versa such data/requirement shall be deemed to be contained in both. Contradictions between drawings and specifications, if any, shall be brought to the attention of the BHEL / customer by the bidder and the correct requirement shall be obtained.

In the event of any conflict between two clauses of specification bidder has to point out those points in pre award stage in clarification / deviation format attached with the specification. In absence of the same BHEL / customer interpretation will prevail after award of contract during detailed engineering.

Unpriced copy of the price bid shall be furnished along with the technical bid.

SECTION - B

(PROJECT INFORMATION)

Sl. No.		Details
1	Name of customer	PUNJAB ELECTRICITY BOARD, BHATINDA
3	Project	GURU HARGOBIND THERMAL PLANT STAGE-II
4	Name of Consultant	TATA CONSULTING ENGINEERS
5	Location of Plant	LEHRA MOHABBAT, DISTT. BHATINDA

SECTION – C

(SPECIFIC TECHNICAL REQUIREMENTS)

1.0 GENERAL

This specification is intended to cover design, engineering, manufacturing, painting, inspection & testing at manufacturer's works, complete with all accessories including start up and commissioning spares, packing, shipment and delivery to Power Station Site for missing items and replacement of defective item in the existing partially supplied/ partially erected chlorination plant. In addition, the bidder's scope shall include erection (except already erected) and commissioning, unloading, storage and handling at site, site testing, trial run, obtaining clearance from Explosive department demonstration tests and handing over to customer the complete CHLORINATION PLANT for 2X250 MW, GHTP STAGE-II, LEHERA MOHABAT UNIT 3 & 4. The scope of supply shall fully cover the requirement of the Design Criteria and Technical Specification of this specification. Also, bidder to include all necessary items like control cables, power cable, screened cables, Cable trays, accessories & cable trays, Cable glands and lugs, Conduit and conduit etc. as required for electrical and control systems to make the system complete in totality. Any modification required in the already supplied equipment shall be in bidder scope.

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Bidder shall ensure that the additional items supplied by the bidder should be interchangeable / compatible with the chlorination already supplied by M/s Banaco and same shall be able to integrate / hook with the existing system. The bidder shall carry out required rectification, erection, commissioning and hand over the plant to customer in running condition. The plant to be commissioned in totality, including the control system, electrical system & mechanical system for successful run of the plant.

The necessary drawings/documents existing plant related to Chlorination Plant enclosed in the specification for the bidders reference. The equipment shall be supplied in line with the already approved data sheet to match/accommodate the equipment to be supplied by bidder in existing facilities.

2.0 SCOPE OF SUPPLY

The Gas Chlorination Plant, shall consist of the followings:

1. List of items as per Annexure-A.
2. Hangers and supports as per the requirement.
3. Start-up and commissioning spares as required.
4. Necessary flanges and counter flanges as applicable for interconnection.
5. Finish paints for touch up painting of equipment after erection at site in sealed container.
6. All steel inserts with lugs, plates, bolts, nuts, sleeves, edge angles and all other embedding components etc. as required to grout in civil works and to support/hold the equipment being supplied under this specification.
7. All auxiliary steel structures (U-clamps, nuts, bolts, channels etc.) for fixing the pipe on the pedestal or trestles.

3.0 SCOPE OF SERVICE

The bidder's scope also includes following services for scope under this specification:

1) Site visit for assessment of balance supply and erection and commissioning.
2) Erection and commissioning, unloading, storage and handling at site.
3) Servicing of already supplied items as required.
4) In site transportation.
5) Arrangement of all instruments and lab facilities to carry out trial run/commissioning and Demonstration test.
6) Complete grouting for equipment, fixing and any concreting inside the vessels and lining.
7) All personnel required during trial run, commissioning and Demonstration Test.
8) Performance testing.
9) Statutory approval from concern agencies as required.

4.0 CIVIL SCOPE

Civil work is excluded from the bidder scope. However steel inserts, plates, bolts, nuts, sleeves and all other embedding components etc. as required to grout their equipment to hold/support shall be in bidder's scope.

5.0 EXCLUSIONS

a) Service air, Instrument air, up to the terminal point.
b) Drinking water and service water.
c) All Civil works at site.

6.0 DRAWING/DOCUEMNTS REQUIREMENT (FOR MECHANICAL/ELECTRICAL/C&I/ETC)

After award of LOI, following drawing/documents shall be submitted by the bidder for BHEL/Customer approval. However, any additional drawing/document if found necessary for completion of the engineering, the same shall be submitted by bidder without any commercial implication.

a) Detailed installation drawings for all instruments and instrumentation schedule.
b) Details Data sheet for instrument etc.

5.0 DRAWING/DOCUEMNTS REQUIRED ALONG WITH THE BID .

- Deviation/clarification, if any, in the BHEL format only.
- Price Schedule duly filled.

NOTE-1: - Any item/work either supply of equipment or erection material which have not been specifically mentioned in but are necessary to complete the woks for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The bidder without any extra charge shall provide the same.

This is a part of technical specification number PE-TS-226-174-A001

Annexure-A

LIST OF ITEM TO BE SUPPLIED

SL. NO.	ITEMS DESCRIPTION	QUANTITY
CW CHLORINATION SYSTEM		
1	Auxiliary tonner liquid connecting valve with yoke clamp. (IS:3224)	8 No's
2	Flexible Copper chlorine liquid connecting pipe with union nuts & rings.	8 No's
3	Manifold liquid isolating Valve.	8 No's
4	3 Way Motorised Operated Ball Valve for change over	1 No's
5	Pressure Indicator	10 No's
6	Temperature Indicator (1 No. on each Manifold Header pipe.	2 No's
7	Pressure Switch	8 No's
8	Pressure switch for high alaram with chem seal& isolating Valve & Rupture Disc (1No. On each manifold header pipe & 1 No. on header pipe) for expansion Chamber for Liquid Chlorine.	3 sets
9	Isolating ball valve.	14 No's
10	Indicating instrument for Evaporator 1 No. Water Temperature Guage, 1No.Outlet Chlorine Gas Pressure gauge 1 No. Outlet Chlorine Gas Temperature Indicator Water Level Control Switch:1 No. Water Level Low Alarm Switch. 1 No.; Water Temperature Control Switch. 1 No.; Water Temperature Low alarm switch 1 No., Water Temperature High Alarm switch. 1-Automatic Water Level Control comprising Make-Up Water Solenoid Valve : 1 No. By Pass Valve. Disc & High Pressure Alarm Switch with Chem-seal & Isolating	1 set

	Valve.	
11	Electrically Motorised Operated Ball Valve on Chlorine Gas Header pipe from Evaporator.	2 No's
12	Filter media for Chlorine Gas filter Capacity 180 kg/hr.	4 no's
13	Chlorine Gas pressure Indicator with Chem-seal& Isolating Valve at Inlet & outlet of Spray Catcher.	4 No's
14	Differential Pressure switch with Chem seal and isolating valve across chlorine gas filter	2 No's
15	Pressure reducing valve (preset Type)	2 No's
16	Vacuum Type Gaseous Chlorinator Capacity 180 kg/hr.	2 No's
17	Differential pressure Switch with isolating valve at inlet & Outlet of Basket type strainer.	2 No's
18	Isolating Gate Valve at Inlet & Outlet of each Strainer.	4 No's
19	Compound gauge with isolating valve on water booster pump suction header pipe,	1 No,
20	By pass Type flow meter with orifice & 2 NOS. Isolating Valve on water supply header pipe.	1 set
21	Leak Detector with 2 Nos sensor Each	2 sets
22	DP Gauge on Chlorine gas line across chlorine gas filter	2 No's
23	Exhaust fans for chlorinator room for 30 air changes	2 No's
	LEAK ABSORPTION SYSTEM	
24	Instruments for the Caustic Solution Tank of Leak absorption system:- 1 NO. Level Guage with 2 NOS. Isolating Valve, 1 No. Level Switch for Low Alarm, 1 No. Temperature Indicator, 1 No. Level Switch for High Alarm, Vent Overflow pipe with fitting (Details as per P&ID) – 15 METER, 1 No. Agitator.	1 set
25	80 NB C.I.R.L.Diaphragm Valve	7 No's
26	90 (OD) CPVC Caustic re-circulating pipe with fittings	30 meter
27	80 NB C.I.R.L.Non-Return Valve on Pump discharge.	2 No's
28	80 NB. 'y' type Strainer on pump Suction pipe	2 No's
29	50 Nb C.I.R.L. Diaphragm valve on flushing water supply pipe at Suction of Caustic Pump.	2 No's
30	Relay based annunciator control panel	In working condition, minor modifications required.
31	Mechanical Platform Dial type weighing scale Cap : 2 Ton.	1 No.
32	Chlorine residual analyser Range 0-5 PPM.	1 No.
33	Safety Shower & Eye wash.	1 No.
RW CHLORINATION SYSTEM		
1	Auxiliary tonner gas connecting valve with yoke clamp (IS:3224)	2 No's
2	Flexible Copper Chlorine gas connecting pipe with union nuts & rings.	2 No's
3	Manifold Isolating Valve.	2 No's
4	2 way 25 mm C.S. Sch.80 ASTM A 106 GRB chlorine gas header pipe with fittings.	12 meter pipe required.
5	Pressure Indicator with Chem Seal & Isolating Valve.	5 No's
6	Pressure Switch with Chemical Seal & Isolating Valve for low alarm.	4 No's
7	25 mm C.S.SCH.80 ASTM-A-106 GRB Chlorine Gas header pipe with fittings.	18 meter pipe required.
8	Chlorine Gas Filter	2 No's

9	Isolating Ball Valve at Inlet & outlet of Gas filter.	4 No's
10	Chlorine Gas differential pressure switch with Chem-Seal & Isolating Valve across Spray Catcher.	1 No.
11	Pressure Reducing Valve Pre-set Type	1 No.
12	Isolating ball valve at Chlorinator gas inlet.	2 No's
13	Vacuum Type Gas Chlorinator capacity 24 kg/hr.	2 No's
14	Gate Valve on Pump Suction & Discharge	4 No's
15	Non-Return Valve on Pump Discharge	2 No's
16	By-Pass flow Meter on water booster pump discharge header pipe	1 No.
17	Gate Valve at Chlorinator Water supply pipe.	2 No's
18	Non-Return Valve at Chlorinator Chlorione Solution Outlet Pipe	2 No's
19	C.I.R.L. Diaphragm Valve at Chlorinator outlet on Chlorine Solution pipe,	2 No's
20	Chlorine residual analyser Range 0-5 PPM.	1 NO.
21	Relay based annunciator plant control panel	1 NO.
22	Mechanical platform Dial type weighing scale Cap : 2 Ton	1 No.
23	Leak Detector with sensor Each	2 NO'S
24	Safety shower & eye wash	1 No.
POTABLE WATER SKID MOUNTEDD HYPOCHLORITE DOSING SYSTEM		
1	Hypochlorite acid dosing tank vertical cylindrical atmospheric type. Capacity : 50 Ltrs. M.O.C. : Non metallic. Each tank consisting of :- Overflow, vent & chemical feeding funnel : 1 Lot, Overflow pipe with 1 No. drain valve.	
2	Hypochlorite dosing pump diaphragm Type with inbuilt non Return valve on pump discharge 2 Nos. (1W+1S/B) Capacity : 0-2 LPH Pressure : 5.0 kg/cm2g. MOC : Polypropylene	
3	Pipe, valves, fittings, instruments as per P&ID.	
SAFETY ITEMS FOR CW AND RW CHLORINATION		
1	BREATHING APPARATUS (45 MINUTES)	4 SETS
2	Canisters type gas masks	2 sets
3	Emergency repair kit B for chlorine tonner	2 sets
4	Ammonia torch	4 sets
5	Weather cock	2 sets
6	Protective clothing	4 sets

Annexure-I

SUB VENDOR LIST

S NO.	ITEM	APPROVED SUPPLIERS	PLACE
1	TANK	BELCO POLLUTION CONTROL PVT LTD	GRATER NOIDA
		FANTECH	PUNE
		TECHNOGAB	NEW DELHI
2	HORIZONTAL CENTRIFUGAL PUMP	KIRLOSKAR BROS. LTD.	PUNE
		M & P	PUNE
		KSB PUMPS LTD	PUNE
		SAM PUMPS	COINBATOR
		BEACON PUMPS	CHENNAI
		MATHER & PLATT	PUNE
		SULZER PUMPS LTD	MUMBAI
3	METERING PUMPA/PRV	METACHEM	MUMBAI
		SWELORE	AHMEDABAD
		V K PUMPS	NASIK
		MILTON ROY ASIA	CHENNAI
4	AGITATOR/STIRRER	REMI	MUMBAI
		FIBRE & FIBRE	FARIDABAD
		MIXRITE	MUMBAI
5	'Y' STRAINER	OTOKLIN	MUMBAI
		JAYPEE	NEW DELHI
		GREAVES COTTON	MUMBAI
		MULTITEX	NEW DELHI
6	ORIFICE PLATE	MICRO PRECISION	FARIDABAD
		INSTRUMENTAION LTD	PALGHAT
		CARLO DYNAMICS	HYDRABAD
7	GATE VALVE	PRECISION ENGG.	MUMBAI
		CRESENT VALVE	MUMBAI
		BDK	HUBLI
		LEADER	JALANDHAR
		HITECH ENGG.	AHEMADABAD
		TECHNO VALVE	
8	GLOBE VALVE	LEADER	JALANDHAR
		HITECH ENGG.	AHEMADABAD
		AUDCO	MADRAS
		KSB	COIMBATORE
		FOURESS	MUMBAI
		CRESENT VALVES	MUMBAI
		BDK	HUBLI
9	NRV CHECK VALVE	LABLINE	MUMBAI
		BDK VALVES	HUBLI
		TECHNO VALVE	
10	SAFETY VALVES / RELIEF VALVES	METACHEM	MUMBAI
		KEYSTONE	BARODA

		V K PUMPS	NASIK
11	3 WAY VALVE	TECHNO VALVE	MUMBAI
		HI TECH	AHMEDABAD
12	PIPING	CHOKSHI TUBES	AHMEDABAD
		REMI	MUMBAI
		RATNAMANI	AHMEDABAD
13	FITTINGS	BHARAT FORGE	PUNE
		RELIANCE FORGE	
		EBY	MUMBAI
		SIDDARTH & GAUTAM	FARIDABAD
		MS FITTINGS	KOLKATA
		PRADEEP METALS LTD	MUMBAI
		TUBE PRODUCT INCOROPORATION	BARODA
14	FLANGES	PRADEEP METALS LTD	MUMBAI
		TUBE PRODUCT INCOROPORATION	BARODA
		RELIANCE FORGE	
15	BALL VALVE	FLOW CHEM	AHMEDABAD
16	PAINT	BERGER PAINTS	KOLKATA
		ASIAN PAINTS	MUMBAI
		SHALIMAR PAINTS	KOLKATA
		JENSON & NICOLSON	KOLKATA
17	LT MOTORS	ASEA BROWN BOVERI	
		SIEMENS	MUMBAI
		KIRLOSKAR ELECTRIC CO LTD.	
		CROMPTON GREAVES LTD	MUMBAI
		BHARAT BIJLEE	MUMBAI
		MARATHON	
		GE-POWER	
		RAJINDRA ELECT INDUSTRIES	
		NGEF	BANGALORE
		LAXMI HYDRAULICS PVT. LTD	
18	PRESSURE GAUGE/DPG	SWITZER (FOR DP GAUGES)	CHENNAI
		A N INSTRUMENTS	KOLKATA
		BELLS CONTROL	KOLKATA
		MANOMETER INDIA	MUMBAI
		GENERAL INST	MUMBAI/GOA
		GLUCK INDIA	MUMBAI
19	LEVEL GAUGES	SIGMA INSTRUMENTS	MUMBAI
		LEVCON	KOLKATA
		SB ELECTRO MECHANICAL	PUNE
20	LEVEL SWITCHES	LEVCON	KOLKATA
		EIP INSTRUMENTS	NOIDA
		EIP BULK CONTROL	DELHI
		SIGMA INSTRUMENTS	MUMBAI
		EIP ENCIRO LEVEL CONTROL	NOIDA
		NIVO CONTROL	INDORE
21	DIFF. PRESURE SWITCH	INDFOS IND	GHAZIABAD
		SWITZER	CHENNAI
		VASUTECH (VARMA TRAFAG , EXCEPT FOR DIAPH. VACCUM TYPE)	REWARI
22	LOCAL CONTROL PANEL	INDSUSTRIAL SWITCHGEAR & CONTROL	MUMBAI
		POSITRONICS	BARODA
		ECS	NOIDA

		SWITCHING CIRCUIT	KOLKATA
		CONTROL & SCHEMATICS	HYDRABAD
		GE POWER	BANGLORE
		SIEMENS	KOLKATA
		C&S	NOIDA
		PYROTECH	UDAIPUR
		L&T	MUMBAI
23	STROKE CONTROLLER	V K PUMPS	NASIK
		METACHEM	MUMBAI
		SWELORE	AHMEDABAD
24	INST CABLES (SCREENED CABLES)	RELIANCE	BANGLORE
		DELTON	FARIDABAD / NEW DELHI
		NICCO	KOLKATA
		CCI	MUMBAI
		UNIVERSAL	SATNA
25	CONTORL CABLES	DELTON	FARIDABAD/NEW DELHI
		FINOLEX	PUNE
26	POWER CABLES (LT CABLES)	CCI	MUMBAI
		NICCO	KOLKATA
		UNIVERSAL	SATNA
		IACL (HVPL)	NEW DELHI
		FGI	KOLKATA
		FINOLEX	PUNE
		INDUSTRIAL CABLE	RAJPURA
27	CPVC PIPE	ASTRAL	AHMEDABAD
		GEORGE FISHER PIPE SYSTEM	MUBMAI

ANY OTHER SUB-VENDOR NOT SPECIFIED IN ABOVE SUB-VENDOR LIST SHALL BE SUBJECT TO APPROVAL OF BHEL/CUSTOMER DURING DETAILED ENGINEERING WITHOUT ANY PRICE AND DELIVERY IMPLICATION TO BHEL.

ANNEXURE-II
PAINTING DETAILS

Paint Reference Scheme	Surface Preparation Grade / Surface Profile	Primer Coat			Intermediate Coat			Finish Coat			Total DFT in microns
		Premier Paint	No. of Coats	DFT in Microns	Intermediate Paint	No. of Coats	DFT in Microns	Finish Paint (See Note)	No. of Coats	DFT in Microns	
Various type of equipment/valve, LP Piping/ structurals/ Vessels, etc. (Temp. upto 90°)	Blast clean to Sa 2^1/2	Red oxide zinc chromate as per IS:2074 (alkyd medium)	1	35 per coat	HB MIO	1	50	Synthetic enamel (alkyd med.) as per IS:2932	2	35 per coat	155
Equipment with (Temp. upto 250°)	- do -	Heat resistant Al – paint	2	20 per coat	-	-	-	Heat resistant Al–paint	2	20 per coat	80
Equipment in corrosive areas like CPU (regeneration) Dosing skid, etc.	Blast clean to Sa 2^1/2	Epoxy resin based zinc phosphate primer	1	35 – 50 per coat	Epoxy based TiO_2 pigmented paint	1	50 per coat	Polyamide cured Epoxy finish coat	2	25 – 35 per coat	135 - 170

Elect. / Control Panels, etc.	Seven tank process	Zinc phosphate (alkyd Medium)	2	25 – 35 per coat	-	-	-	Synthetic enamel (alkyd med.) as per IS:2932	2	20 – 25 per coat	90 - 120

Notes:

1. Surface preparation shown is as per Swedish Standards SIS 05-5900. Degreasing will be as per Standard SSPC-SP1.
2. Incase of insulated surfaces, only primer coats shall be applied.
3. All instruments shall be painted as per manufacturer standard practice.
4. All structural steel items shall be painted at site. Piping shall go with primer coating & finish paint shall be applied at site. Equipment shall be finish painted at shop.
5. Method of painting application shall be as per paint manufacturer's recommendation.

ANNEXURE-III
DRAWING/DOCUMENT DISTRIBUTION SCHEDULE

Sl. No.		Soft copy	Hard Copy	CD
1	First Submission to BHEL	1 copy (in .pdf through wrench)	Not required	Not required
2	Subsequent re-submission to BHEL	1 copy (in .pdf through wrench)	Not required	Not required
3	First Submission to customer	1 copy (in .pdf through wrench)	5 copies	Not required
4	Subsequent re-submission to customer	1 copy (in .pdf through wrench)	Not required	Not required
5	After approval by customer	Not required	6 copies for formal approval by stamping & distribution	Not required
6	As-built drawing, O&M Manual & distribution drawings	1 copy (in .pdf through wrench)	As required, exact quantity to be informed later	As required, exact quantity to be informed later
Note: - AutoCAD copy of equipment layout, cable trench/tray/routing layout & foundation drawings as well as cable schedule in MS-EXCEL format shall be submitted along with soft copy in .pdf format.				

Bidder to note that the successful bidder, during detail engineering, will submit the drg/doc through web based Document Management System in addition to hard copies to be submitted. Bidder would be provided access to the DMS for drg/doc approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end

1.Internet explorer version – Minimum Internet Explorer 7

2. Internet speed – 2 mbps (Minimum preferred)

Pop ups from our external DMS IP (124.124.36.198) should not be blocked

Vendor's Internal proxy setting should not block DMS application's link

http://124.124.36.198/wrenchwebaccess/login.aspx)"

DMS user manuals to be used by BHEL PEM vendors for uploading, viewing, revising, commenting and tracking documents on PEM's DMS have been uploaded on PEM internet website (www.bhelpem.com) under the Vendor session. For quick access bidder may refer the link ttp://bhelpem.com/DMSManuals/DMSManuals.html

ANNEXURE-IV
P&ID & EQUIPMENT LAYOUT

FIRST ANGLE PROJECTION

VENT TO CAUSTIC PIT
DRG. NO. BNC/4472 REV 0 SHEET 2
GRID (H-16)

32 OD PVC CLASS V CHLORINE GAS VENT PIPE(TYP)

150 NB MS IS:1239 HEAVY GRADE WATER SUPPLY PIPE

CHLR-1

CHLR-2

REMOTE VACCUM REGULATOR(TYP)

HEATER WITH CONTROLLER ON/OFF BASED ON TEMP. 15 KW, 440 V, AC 1 PH,50 HZ(TYP)

CHLORINATOR (TYP)
MODEL : V-721
CAP : 180 KG/HR EACH
(1W+1S/B)

20 OD PVC IS:4984 CLASS V CHLORINE GAS VENT PIPE (TYP)

25 NB PVC IS:4984 CLASS V CHLORINE GAS VACCUM PIPE (TYP)

150 NB MS IS:1239 HEAVY GRADE WATER SUPPLY PIPE

150 NB MSRL CHLORINE SOLUTION PIPE

200 NB MSRL CHLORINE SOLUTION PIPE

32 OD PVC CLASS V CHLORINE GAS VENT PIPE(TYP)

32 OD PVC PIPE (TYP) FOR CHLORINE GAS VENT PIPE(TYP)

EXHAUST FAN

LOGIC-003

LOGIC-002

LOGIC-004

EVAPORATOR
MODEL : 75/1100/E
CAP : 180 KG/HR EACH
(1W+1S/B)

EVAP-1

EVAP-2

25 NB CS SCH 80 SA 106 GR-B MANIFOLD HEADER PIPE FOR 4 NOS TONNER (TYP)

25 NB CS SCH 80 SA 106 GR-B CHLORINE LIQUID HEADER PIPE (TYP)

MANIFOLD VALVE

10.5 MM ID FLEXIBLE COPPER CONNECTING PIPE (TYP)

AUXILIARY TONNER VALVE

TRUNNION TYPE ROLLER SUPPORT (TYP)

CHLORINE TONNER CAP. 630 KGS EACH (TYP) QTY :- 18 NOS

CHLORINE TON CONTAINERS (TOTAL 18 NOS)

CENTRIFUGAL PUMP (TYP.)
(1W+1S/B)
CAP : 90 M³/HR.
PUMP HEAD : 30 MWC
TOTAL HEAD : 50 MWC
MOTOR RATING:
15KW, 1480 RPM
415 V, 3 Ph,50 Hz.

150 NB MS IS:1239 (HEAVY) WATER SUPPLY PIPE

125 NB (TYP) MS IS1239 (HEAVY)

150 NB (TYP) MS IS1239 (HEAVY)

200 NB MS IS:3589 GR Fe 410 WATER SUPPLY PIPE

50 NB MS IS:1239 (HEAVY) TAPPING FOR MAKE UP WATER TO CAUSTIC TANK REF DRG NO:-BNC/4472 SHEET 2

BANACO SCOPE

200 NB MSRL CHLORINE SOLN HEADER PIPE

200 NB MSRL PIPE (TYP)

100 NB MSRL CHLORINE SOLN BRANCH PIPE (TYP)

C.W. SUMP (BY CUSTOMER)

ALLDOS MAKE ANALYSER
RANGE: 0 TO 5 PPM
FOR MONITORING(PORTABLE TYPE)

SAMPLE WATER

3 TON CAPACITY ELECTRICALLY OPERATED MONORAIL HOIST WITH LOAD INDICATOR & TROLLEY.

MONORAIL

3 TON CAP. CRANE WEIGHER

TON CONTAINER LIFTING BEAM

PLATFORM TYPE MECHANICAL WEIGHING SCALE CAP:2 TON

SAFETY SHOWER & EYE WASH

LEGENDS

NEEDLE VALVE IS : 3224
BALL VALVE
GATE VALVE
DIAPHRAM VALVE
NON RETURN VALVE
PRESSURE REDUCING VALVE PRESET TYPE
SOLENOID VALVE
SAFETY RELIEF VALVE
RUPTURE DISC
MOTOR
CHEMICAL SEAL
BASKET TYPE STRAINER
ALARM LOW
ALARM HIGH
ELECTRIC SIGNAL
DYE-PACS TYPE FLOW GAUGE
TEMPERATURE SWITCH
TEMPERATURE CONTROL SWITCH
AMMETER
PRESSURE SWITCH
VACUUM SWITCH
CHLORINE LEAK DETECTOR
PRESSURE INDICATOR
TEMPERATURE INDICATOR
LEVEL INDICATOR
LEVEL SWITCH
DIFFERENTIAL PRESSURE INDICATING SWITCH TYPE
MOTORISED BUTTERFLY VALVE
PRESSURE RELIEF VALVE
FLOW INDICATOR
MOTORISED VALVE (REGULAR)
NON RETURN VALVE
CHLORINE GAS FILTER
MOTOR WITH STARTER SWITCH
FOOT VALVE WITH IN BUILT CHECK VALVE
PRESSURE GAUGE
MOTORISED BALL VALVE

NOTES:

1. CHLORINE LEAK DETECTORS ARE PROVIDED FOR DETECTING CHLORINE LEAKAGE IN DRUM STORAGE AREA(1 NO.), IN CHLORINATOR AND EVAPORATOR AREA (1 NO.) TO MAKE AN ALARM AND INTERLOCK FOR START CHLORINE LEAK ABSORPTION SYSTEM.
2. OFF/ON LOCAL PUSH BUTTON IS PROVIDED BY BHEL FOR ALL DRIVES
3. REFER CONTROL PANEL DRAWING FOR DETAILS REGARDING HAND SWITCHES AND INDICATING LAMPS ETC.
4. STARTING & STOPPING OF THE PLANT & SYSTEM WAS DESCRIBED ABOVE.
5. IN CASE EVAPORATOR RUPTURE DISC BURST PRESSURE SWITCH OPERATES AND GIVES ALARM AT ANNUNCIATOR IN CONTROL PANEL IMMEDIATELY OPERATING TUNNER (BATTERY MANIFOLD VALVE TO BE CLOSED MANUALLY AND SYSTEM TO BE RUN MANUALLY FOR EVACUATION OF CHLORINE GAS FROM THE SYSTEM.
6. IN CASE OF WORKING CHLORINE GAS FILTER CHOKED/JAMS DIFFERENTIAL PRESSURE INDICATING SWITCH ACTUATES AND GIVE ALARM TO ANNUNCIATOR CONTROL PANEL IMMEDIATELY STAND BY CHLORINE GAS FILTER TO BE TAKEN IN SERVICE AND CHOKED -UP FILTER MEDIA TO BE CHANGED/CLEANED.
7. DURING WORKING CHLORINATOR VACUUM SWITCH HIGH ALARM GETS ACTUATED IT GIVES AND ALARM TO ANNUNCIATOR CONTROL PANEL IMMEDIATELY STOP THAT CHLORINATOR &
8. IN CASE OF EVAPORATOR TEMPERATURE SWITCH HEATER TEMPERATURE CONTROL SWITCH (TCS)
9. IN CASE OF SAFETH RELIEF VALVE AT EVAPORATOR MANUALLY CHLORINE LIQUID INLET VALVE AT
10. IN CASE RUPTURE DISC DOES'S NOT BURST EVAPORATOR OUTLET GIVES ALARM
11. ALL VALVES & PIPING SHALL BE AS PER
12. PIPE SIZE MENTIONED ARE IN MM

LOW ALARM DUE TO MALFUNCTION OF STAND BY EVAPORATOR TO BE STARTED

OR GAS OUTLET OPENS, EVAPORATOR TO BE CLOSED

PRESSURE HIGH ALARM SWITCH AT LATOR CONTROL PANEL. V FOR EVACUATION OF GAS TO CAUSTIC PIT

LOGIC NOTES:-

LOGIC-001:- WHEN ON-LINE DUTY CONTAINER 1 KG/CHLOR AUTOMATICALLY

LOGIC-002:- EVAPORATOR ELECTRIC HEATER WILL TEMPERATURE HIGH ON LEVEL LOW GAS PRESSURE HIGH, HEATER WILL BE TEMPERATURE HIGH & SAFETY RE HIGH ANNUNCIATION PROVIDED IN HIGH ANNUNCIATION MODULE

LOGIC-003:- WHEN THE PRESSURE DROP TO 1 KG/CM² SHALL BE BROUGHT TO SERVICE

SWITCHED OFF ON WATER BATH ON CHLORINATOR VACUUM LOW OR ON VALVE PRESSURE HIGH, HEATER WILL BE TEMPERATURE IS NOT HIGH AND LEVEL IS ESTABLISHED

LOGIC-003:- V-84/85 WILL BE CLOSED ON WATER BATH TEMPERATURE LOW OR ON VACUUM LOW

LOGIC-004:- SOLENOID VALVE ON THE MAKE-UP WATER INLET TO EVAPORATOR WILL BE OPENED ON WATER BATH LEVEL LOW, THE SAME WILL BE CLOSED ON LEVEL HIGH (CONTROLLED BY WLC).

LOGIC-005:- BOOSTER PUMPS WILL BE STARTED/STOPPED MANUALLY. IN CASE OF RUNNING PUMP TRIP ON OVER LOAD, THE STAND BY PUMP WILL BE STARTED AUTOMATICALLY. IN CASE OF DISCHARGE PRESSURE LOW, THE STAND BY PUMP WILL BE STARTED PUMP GETS TRIPS ON SUCTION PRESSURE LOW.

P&ID FOR CW chlorination

FIRST ANGLE PROJECTION

VENDOR DRG. NO. BNC/4474

	SAFETY RELIEF VALVE
	BALL VALVE
	CHEMICAL SEAL.
PI	PRESSURE INDICATOR.
LG	LEVEL GAUGE
LS	LEVEL SWITCH

15 NB PP PIPE

HINGED COVER FOR CHEMICAL FEEDING

CHEMICAL DOSING TANK
CAPACITY : 50 LTRS
M.O.C : FRP
QTY : 1 NO
SIZE : 0.3 MTR ø X 1.0 MTR.
H.O.S. X 3 MM THK.

V-254

L
A
LS-5

LG

V-253

V-255

D.V.

V-252

V-256

15 NB X 1 MTR LONG
PP DIFFUSER TUBE

DRAIN

15 NB PP PIPE

V-250

PI-26

V-248

V-246

V-251

PI-27

V-249

V-247

PUMP-1

PUMP-2

HYPOCHLORITE DOSING PUMP
DIAPHRAGM TYPE
CAPACITY : 0-2 LPH
PRESSURE : 5.0 Kg/Cm2g
QTY : 2 NOS (1W+1S/B)
MOTOR : 0.37 KW,415 V,3PH,50HZ

V-244

V-245

15 NB PP PIPE

PUNJAB STATE ELECTRICITY BOARD, PATIALA

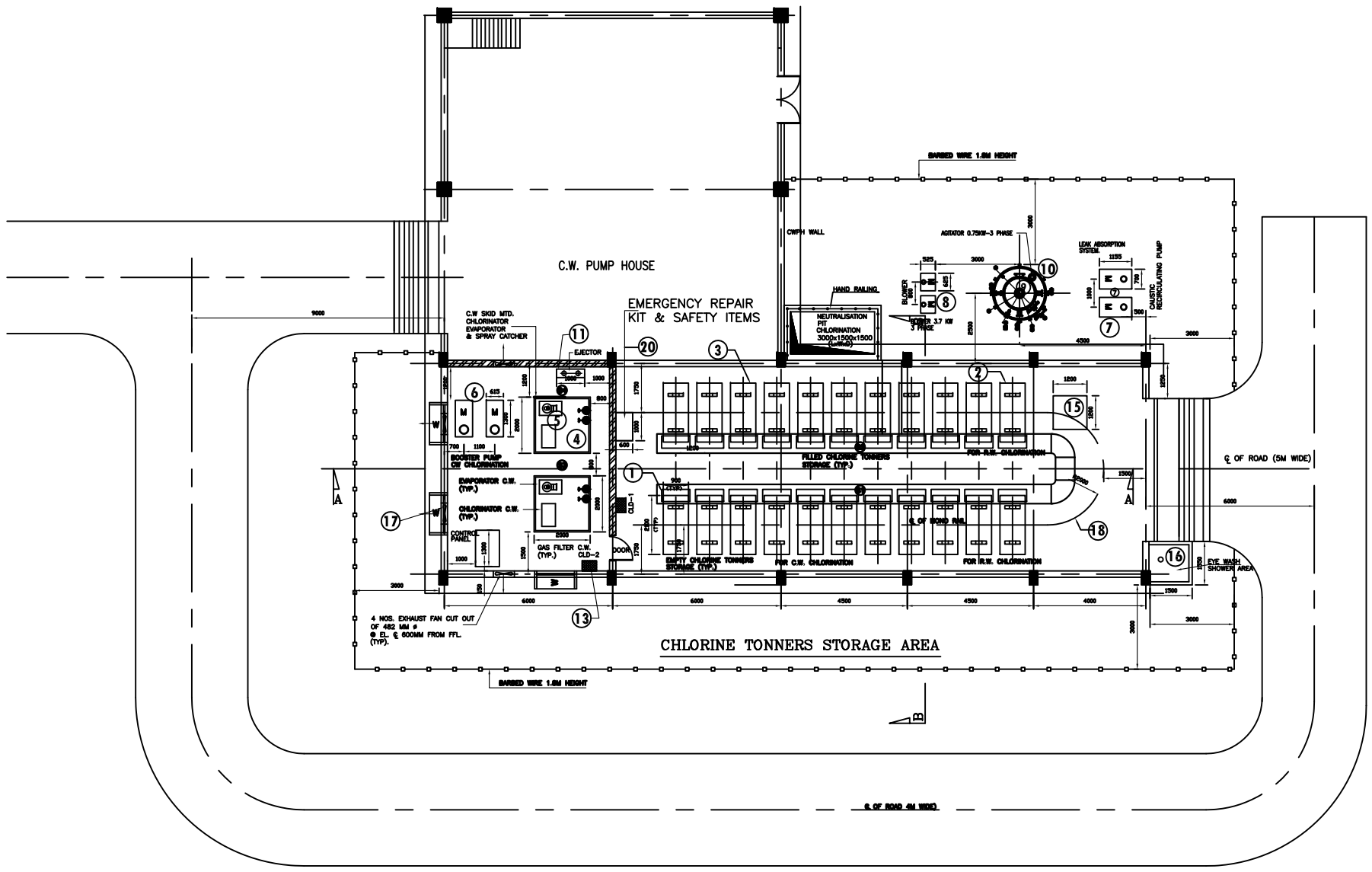
TCE CONSULTING ENGINEERS LTD. BANGALORE

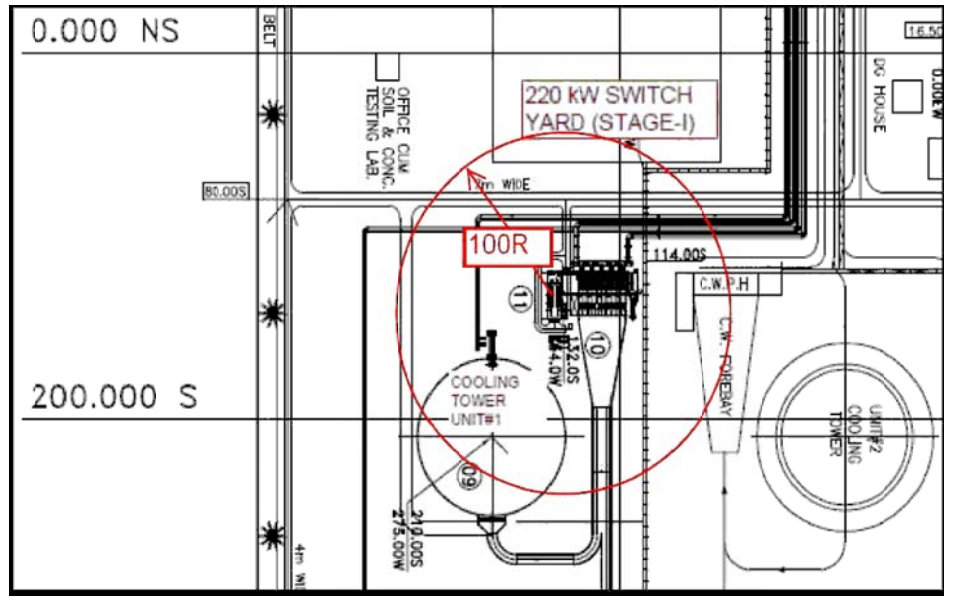
BHARAT HEAVY ELECTRICALS LTD

BARADI

FIRST ANGLE PROJECTION

VENDOR DRG. NO.





KEY PLAN

SPECIFICATION FOR CHLORINE TONNERS	
DESIGN CODE	ASME SECTION VIII DIV.1 (2004)+ADDENDA 2005
DESING PRESSURE	20.63 kgf/cm2 (g)
DESIGN TEMPERATURE	65 deg C
MATERIAL OF CONSTRUCTION (FOR HEAD & SHELL)	SA 516 GRADE 60
CORROSION ALLAWANCE	NIL (WEAR & TEAR ALLOWANCE -1.5 FOR SHELL & 1 mm FOR D/END
LONGITUDINAL SHELL JOINT CAUSTIC PUMP WITH MOTOR & HEAD TO SHELL JOINT	FUSION WELDED
RADIOGRAPHY	FULL
POST WELD HEAT TREATMENT	YES
HYDRAULIC TEST PRESSURE	30 KG/CM2(g)
CLEANING	BY GRIT BLASTING
PAINTING	GOLDEN YELLOW PAINT
DESIGN APPROVAL	THE CHIEF CONTROLLER OF EXPLOSIVES, DEPT OF EXPLOSIVES GOVT. OF INDIA NAGPUR
INSPECTION	LLOYD'S REGISTER ASIA
TARE WEIGHT	600 KGS APROX.
WATER CAPACITY	780 KGS (APPROX.)
CHLORINE CAPACITY	920 KGS (APPROX.)

SR.NO.	LIST OF EQUIPMENT	QTYS.
1.	FRP FROTAL HOOD	22 NOS.
2.	CHLORINE TONNER FOR RW	04 NOS.
3.	CHLORINE TONNER FOR CW	18 NOS.
4.	CHLORINATOR (SKID)	02 NOS.
5.	EVAPORATOR (SKID)	02 NOS.
6.	BOOSTER PUMP WITH MOTOR	02 NOS.
7.	CAUSTIC PUMP WITH MOTOR	02 NOS.
8.	BLOWER WITH MOTOR	02 NOS.
9.	ABSORPTION TOWER	01 NO.
10.	CAUSTIC SOLUTION TANK (CAP:)	01 NO.
11.	EJECTOR	02 NOS.
12.	BASKET STRAINER	02 NOS.
13.	CHLORINE LEAK DETECTOR MONITOR	02 NOS.
14.	CHLORINE LEAK DETECTOR SENSOR (S1 TO S4)	04 NOS.
15.	WEIGHING SCALE	01 NO.
16.	SAFETY SHOWER & EYE WASH	01 NO.
17.	EXHAUST FAN	04 NOS.
18.	ELECTRICALLY OPERATED MONORAIL HOIST CAP.-3 TON (1No. INSTALLED)	01 NO.
19.	LIFTING BAR ASSEMBLY (CAP.-3 TON.)	01 NO.
20.	EMERGENCY REPAIR KIT & SAFETY ITEMS	01 NO.

SR.NO.	SAFETY ITEMS LIST	QTY.
1	SELF CONTAINED BREATHING APPARATUS	2 NOS. FOR CW 2 NOS. FOR RW
2	CANNISTER TYPE GAS MASK	1 SET FOR CW 1 SET FOR RW
3	EMERGENCY REPAIR KIT FOR CHLORINE TONNER	1 SET FOR CW 1 SET FOR RW
4	AMMONIA BOTTLES	2 NOS. FOR CW 2 NOS. FOR RW
5	WEATHER COCK	1 NO. FOR CW 1 NO. FOR RW
6	PROTECTIVE CLOTHING	2 SETS FOR CW 2 SETS FOR RW
7	SAFETY SHOWER	1 NO. FOR CW 1 NO. FOR RW

NOTE

1. ALL DIMENSIONS ARE IN MM EXCEPT ELEVATION.
2. COMPLETE CIVIL WORKS INCLUDING FOUNDATIONS,FLOORING TRENCHES ETC SHALL BE PROVIDED (BY BHEL)
   GROUTING AND PACKING PLATES.EMBEDMNTS,LINING ETC.SHALL BE SUPPLIED & PLACED BY THE BANACO
3. 'M' INDICATES MOTOR.
4. IN THE EVENT OF LEAKAGE FROM CHLORINE TONNER CONTAINER CHLORINE LEAK DETECTOR WILL GIVE AUDIO VISUAL ALARM WHEN CONCENTRATION OF CHLORINE EXCEED 3PPM AND IT WILL START CAUSTIC RE CIRCULATION PUMPS & BLOWERS. THE RANGE OF CHLORINE LEAK DETECTOR PROVIDED NEAR CHLORINATOR IS OF RANGE 0.5 TO 6 PPM & NEAR TONNERS IS OF 0 TO 0.5 PPM

REFERENCE DRAWING

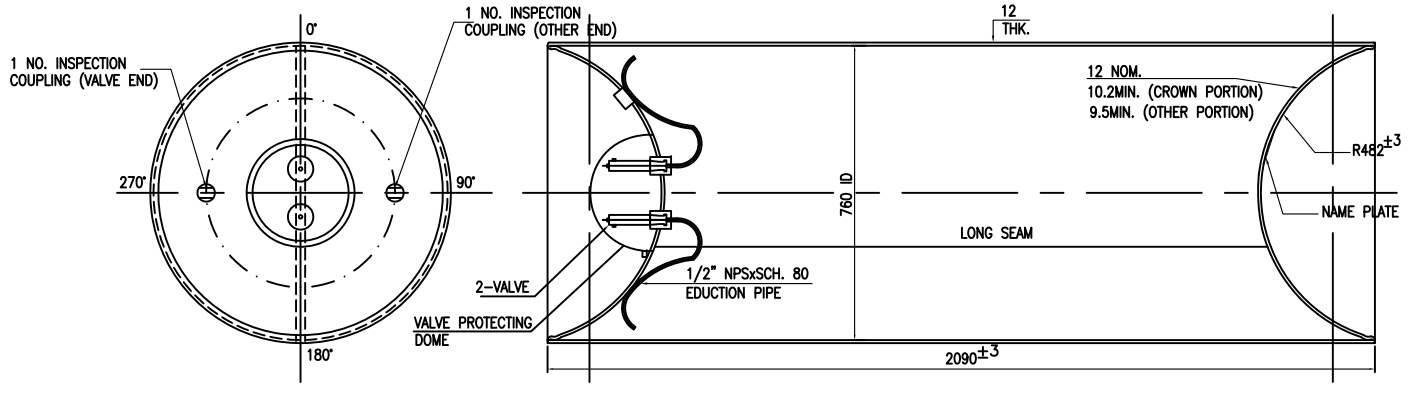
1. P & I DIAGRAM NO. BNC/4480 FOR C.W CHLORINATION SYSTEM.

STANDARD ACCESSORIES PROVIDED WITH THIS CONTANER:

2 NOS. BRASS VALVES OF SIZE 1" NB BS 341 PART1 OR 25.4 MM IS 3224 OR 3/4" NGT (CL) 1
2 NOS. BRASS PLUGS OF SIZE 1" NB BS 341 PART1 OR 25.4 MM IS 3224 OR 3/4" NGT (CL) 1
1 NO. MS VALVE PROTECTING DOME.

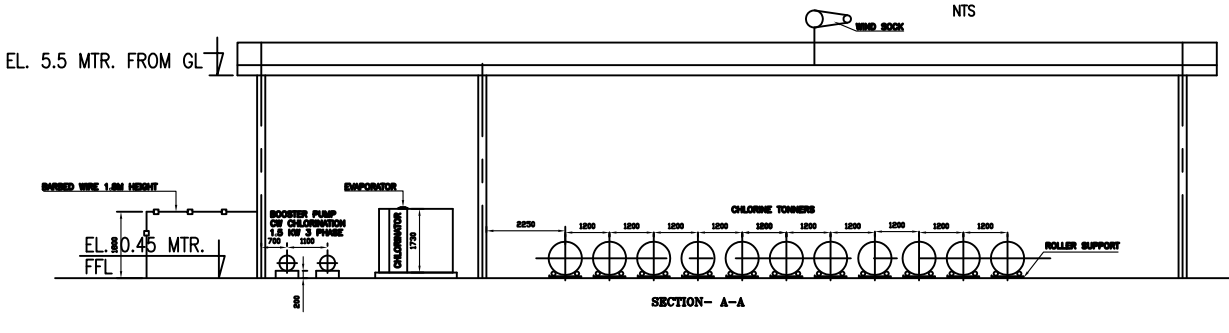
NOTES:

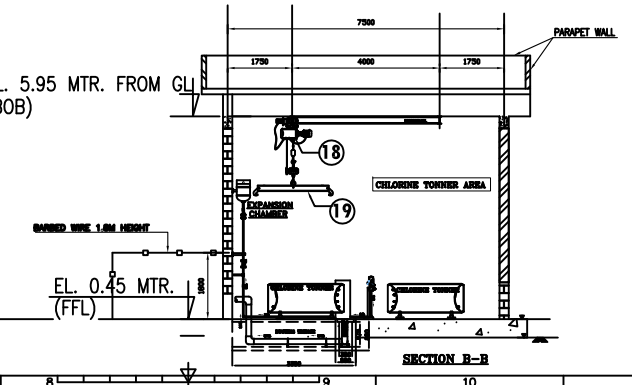
1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
2. INSPECTION COUPLING TO BE PLUGGED WITH BRASS PLUG AS PER SERVICE REQUIREMENT.



TONNER CONSTRUCTION DETAILS

NTS





JOB NO.	226
STATUS	CONTRACT
DRG./REF. NO. (INTERNAL)	—
PRINT SCALE	0 2 4 6 8 10 20 30 40 50

REV.	DATE	ALTD	CHD	APPD

OWNER: PUNJAB STATE ELECTRICITY BOARD PATIALA

PROJECT: 2 X 250 MW GHTP LEHRA MOHABBAT THERMAL POWER PROJECT

CONSULTANT: TCE CONSULTING ENGINEERS LTD. BANGALORE

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI

DEPT CODE		NAME	SIGN	DATE
	DRN			
	DESN			
	CHD			
	APPD			

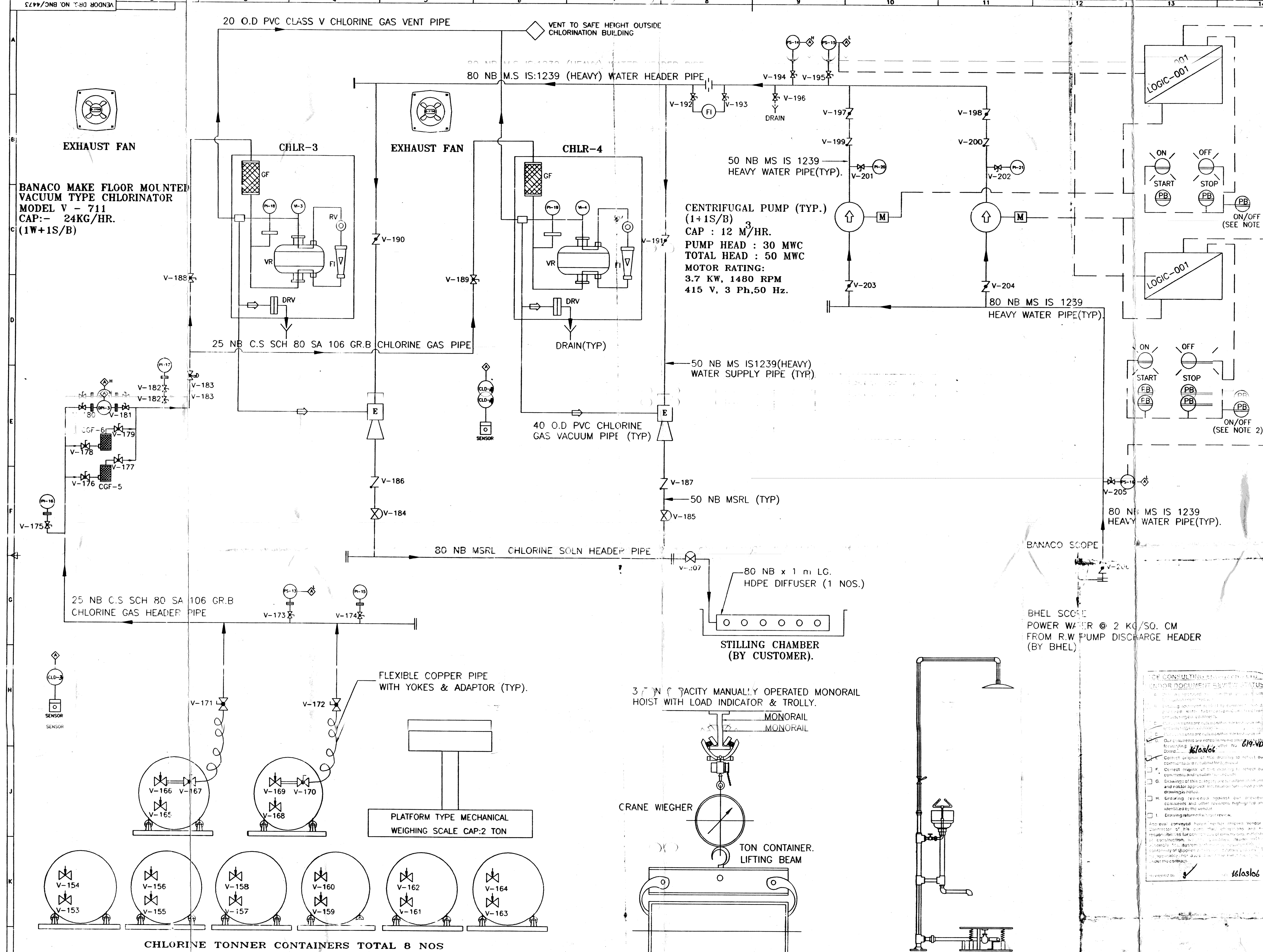
SUB-CONTRACTOR : BANACO
BABUBHAI NAROTTAMDAS & CO.
BANACO HOUSE,P-1,CAMA IND.ESTATE
WALBHAT ROAD,GOREGAON (E) MUMBAI-400 063
PHONE:- 2685 1386,5699 7530 FAX:022-2685 2182

TITLE :- EQUIPMENT LAYOUT FOR C.W. CHLORINATION SYSTEM

DEPT.	SCALE	DRAWING NO.
		PE-V0-230-174-A-005
SIGN		BANACO DRG NO :- BNC/4509
DATE		SHEET 1 OF 1 REV. B

COMPUTER FILE NAME

FOLD



LEGENDS

	NEEDLE VALVE IS : 3224.
	BALL VALVE.
	BUTTERFLY VALVE
	DIAPHRAGM VALVE.
	NON RETURN VALVE.
	CHEMICAL SEAL.
FI	BY PASS TYPE FLOW INDICATOR
AL	ALARM LOW.
AH	ALARM HIGH.
	ELECTRIC SIGNAL.
	CHLORINE GAS FILTER
PS	PRESSURE SWITCH. PRESSURE SWITCH.
PI	PRESSURE INDICATOR.
VI	VACUUM INDICATOR.
DPI	DIFFERENTIAL PRESSURE INDICATING SWITCH
RV	RATE VALVE (MANUAL)
FI	FLOW INDICATOR (ROTAMETER TYPE)
VR	VACUUM REGULATOR
DRV	DRAW RELIEF VALVE
GF	GAS FILTER
CLD	CHLORINE LEAK DETECTOR
E	EJECTOR WITH IN BUILT CHECK VALVE
	PRESSURE REDUCING VALVE (PRESET TYPE)

NOTES:

1. CHLORINE LEAK DETECTORS ARE PROVIDED FOR DETECTING CHLORINE LEAKAGE IN DRUM STORAGE ROOM(1 NO.), IN CHLORINATOR AREA (1 NO) TO MAKE AN ALARM
2. OFF/ON LOCAL PUSH BUTTON S PROVIDED BY BHEL FOR ALL DRIVES
3. REFER CONTROL PANEL DRAWINGS FOR DETAILS REGARDING HAND SWITCHES AND INDICATING LAMPS ETC.
4. STARTING & STOPPING OF THE PLANT & CHLORINE FLOW RATE SELECTION SHALL BE MANUAL
5. IN CASE OF WORKING CHLORINE GAS FILTER CHOKED/JAMMS DIFFERENTIAL PRESSURE INDICATING SWITCH. ACTUATES AND GIVE ALARM TO ANNUNCIATOR CONTROL PANEL IMMEDIATELY STAND BY CHLORINE GAS FILTER TO BE TAKEN IN SERVICE AND CHOKED -UP FILTER MEDIA TO BE CHANGED/CLEANED.
6. ALL VALVES & PIPING SHALL BE AS PER CHLORINE INSTITUTE USA.
7. PIPE SIZE MENTIONED ARE IN MM

LOGIC-001

BOOSTER PUMPS WILL BE STARTED/STOPPED MANUALLY. IN CASE OF RUNNING PUMP TRIP ON OVER LOAD THE STAND BY PUMP WILL BE STARTED AUTOMATICALLY. IN CASE OF DISCHARGE PRESSURE LOW ,THE STAND BY PUMP WILL BE STARTED AUTOMATICALLY. PUMP GETS TRIP ON SUCTION PRESSURE.

C.E./THERMAL DESIGN, PSEB, PATIALA
VENDOR DOCUMENTS REVIEW STATUS
1. Copies of final distribution.
2. Approved.
3. Approved except as noted. Forward final drgs. (Proceed for manufacture/construction parallely.)
4. Approved except as noted rectification. Resubmission is required.
5. Not approved. See accompanying letter.
6. For information and record only.
Refer Memo No. MD-III/792/5586/07 Date 3/-3-06
Approval of the Supplier's drawings by the purchaser does not relieve the Supplier or any part of supplier's obligation to meet all the requirements of the specification, Purchase Order or of the responsibility for the correctness of the supplier's drawings or documents.

CHECKED	RECOMMENDED	APPROVED
AD/MD	DD/MD	DIR/MECH.

619-VDT/04
Reviewed by ... 16/03/06

BHEL DWG.NO.PE-DG-226-174-A002

OWNER: PUNJAB STATE ELECTRICITY BOARD, PATIALA

PROJECT: 2x250MW GGTP LEHRA MOHABBAT THERMAL POWER PROJECT STAGE-II, UNITS 3 & 4

CONSULTANTS: TCE CONSULTING ENGINEERS LTD, BANGALORE

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI

VENDOR: BANACO — BABUBHAI NAROTTAMDAS & CO.

JOB NO. : 226
STATUS : CONTRACT
DISCRIBUTION :

	NAME	SIGN.	DATE
DRN	SHITAL		5/12/05
DESN	V.K.M		
CHD	D.R.K		
CHD	D.R.K		
APPD	R.B.K		

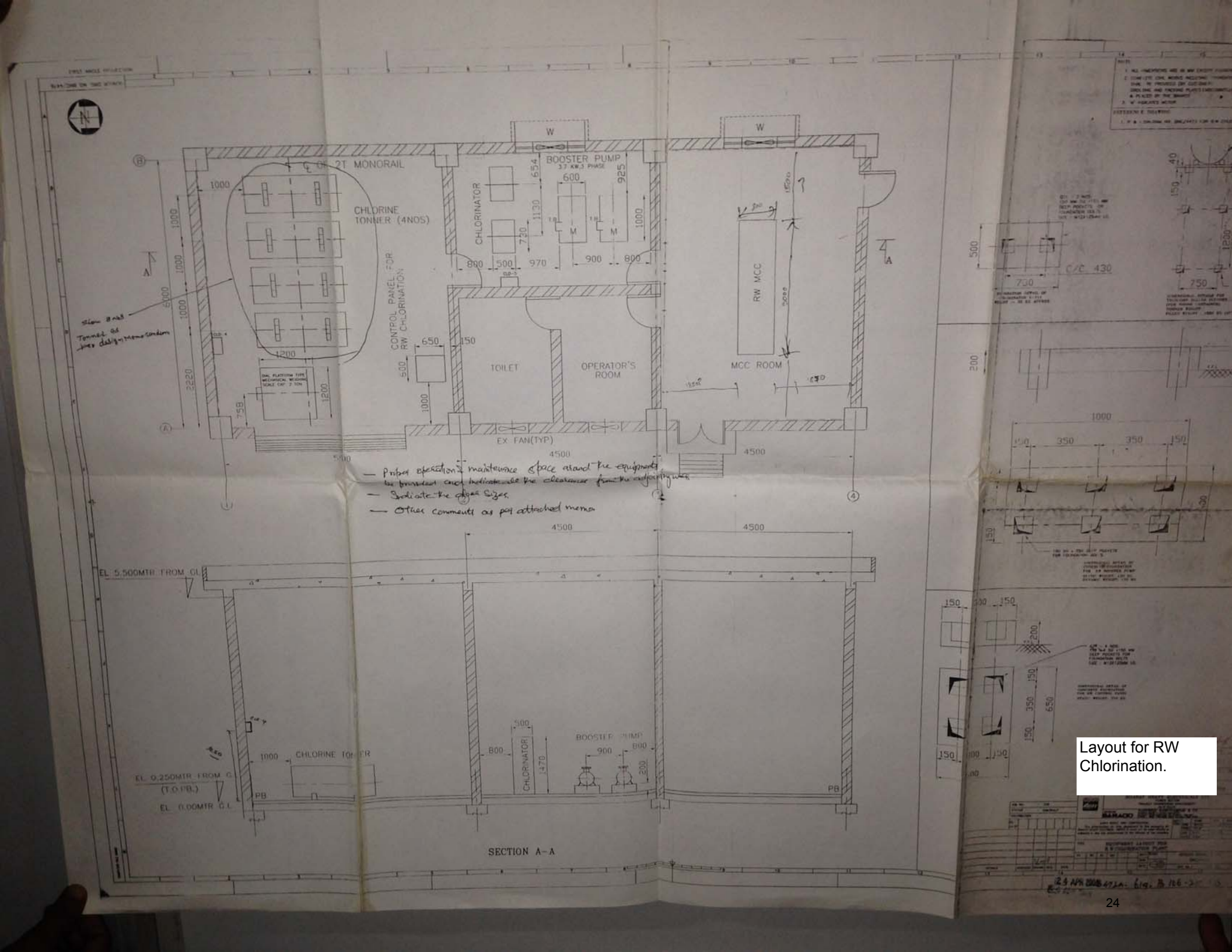
DETAILS	CHECKED	DRAWN	REV.	DATE
AS PER FICHTNER COMMENTS DTD 16/1/06	V.K.M	R.P		

TITLE: P & I DIAGRAM FOR R.W CHLORINATION PLANT

VENDOR DRAWING NO. BNC/4473
SHT. No 1 REV. R1

03 MAR 2006

34721.619.B106.14 RD


CHLORINE TONNER (4NOS)
CONTPOL PANEL FOR RW CHLORINATION
CHLORINATOR
BOOSTER PUMP
TOILET
OPERATOR'S ROOM
MCC ROOM
RW MCC
EX FAN(TYP)
— Proper operation & maintenance space around the equipments to be provided once indicate all the clearances from the adjoining walls
— Indicate the door sizes
— Other comments as per attached memo
EL 5.500MTR FROM GL
EL 0.250MTR FROM GL (T.O.P.B.)
EL 0.00MTR G.L
PB
SECTION A-A
Layout for RW Chlorination.

ANNEXURE-V

DATASHEETS

C.E./ THERMAL DESIGN, PSEB, PATIALA

VENDOR DOCUMENTS REVIEW STATUS

1. Copies of final distribution.
2. Approved.
3. Approved except as noted. Forward final drgs. (Proceed for manufacture/construction parallelly)
4. Not approved except as noted rectification. Resubmission is required.
5. Not approved. See accompanying letter.
6. For information and record only.

Refer Memo No. MD.....Date.....

Approval of the Supplier's drawings by the purchaser does not relieve the Supplier or any part of supplier's obligation to meet all the requirements of the specification. Purchase order or of the responsibility for the correctness of the supplier's drawings or documents.

CHECKED	RECOMMENDED	APPROVED
AD/MD-I	DD/MD-I	BIR/MECH

TCE CONSULTING ENGINEERS LTD.,

VENDOR DOCUMENT REVIEW STATUS

- ☐ A. Drawing approved as submitted: proceed with fabrication/construction.
- ☐ B. Drawing approved subject to comments noted proceed with fabrication/Construction considering our comments.
- ☐ C. Our comments are noted on this marked up print.
- ☑ D. Our comments are noted in memo attached to the forwarding transmittal letter No. TCE 3472A-IC-VDT/206 Dated 09.05.06
- ☐ E. Correct original of this drawing to reflect our comments and resubmit for approval.
- ☐ F. Correct original of this drawing to reflect our comments and resubmit for records.
- ☐ G. Drawings of this category are for information only and not for approval. Information furnished on the drawing is noted.
- ☐ H. Drawing reviewed against our previous comments and other revisions highlighted and identified by the vendor.
- ☐ I. Drawing returned without review.

Approval conveyed herein neither relieves Vendor / Contractor of his contractual obligations and his responsibilities for correctness of dimensions, materials of construction, weights, quantities, design details, assembly fits, system performance requirements and conformity of supplies with Indian statutory Laws as may be applicable, nor does it limit the Purchaser's rights under the contract.

Reviewed by ..... Date 09.05.06

02 Nos Spot Contacts Shall be provided.

② Sensing element Shall be SS-316.

③ BHEL Shall ensure that wetted parts of Sensing element Shall be compatible to the process fluid.

OWNER:	PUNJAB STATE ELECTRICITY BOARD PATIALA
PROJECT:	2 X 250MW GHTP LEHRA MOHABBAT THERMAL POWER PROJECT STAGE – II, UNITS 3 & 4
OWNER'S CONSULTANT:	TCE CONSULTING ENGINEERS LIMITED BANGALORE
CONTRACTOR:	BHARAT HEAVY ELECTRICALS LTD. POWER SECTOR PROJECT ENGINEERING MANAGEMENT- NEW DELHI
ENGINEERING SUB CONTRACTOR:-	FICHTNER CONSULTING ENGINEERS(INDIA) PVT. LTD. CHENNAI.
VENDOR	BABUBHAI NAROTTAMDAS & CO. 'BANACO HOUSE' P-1, CAMA INDUSTRIAL ESTATE, WALBHAT ROAD, GOREGAON (EAST), MUMBAI - 400063

Prepared by	Checked by	Approved by	TITLE: -
PBP	VKM	DRK	PRESSURE SWITCH

BHEL DOC NO. –	DOCUMENT NO. –	REV. –
PE-DC-226-174-A053	BNC/A/1115/DS/40-01 (SHEET 1 OF 5)	R0

2 MAY 2006

3472A·619·B106·40 R0

OWNER:	PUNJAB STATE ELECTRICITY BOARD PATIALA
PROJECT:	2 X 250MW GHTP LEHRA MOHABBAT THERMAL POWER PROJECT STAGE – II, UNITS 3 & 4
OWNER'S CONSULTANT:	TCE CONSULTING ENGINEERS LIMITED BANGALORE
CONTRACTOR:	BHARAT HEAVY ELECTRICALS LTD. POWER SECTOR PROJECT ENGINEERING MANAGEMENT- NEW DELHI
ENGINEERING SUB CONTRACTOR:-	FICHTNER CONSULTING ENGINEERS(INDIA) PVT. LTD. CHENNAI.
VENDOR	BABUBHAI NAROTTAMDAS & CO. 'BANACO HOUSE' P-1, CAMA INDUSTRIAL ESTATE, WALBHAT ROAD, GOREGAON (EAST), MUMBAI - 400063

Prepared by	Checked by	Approved by	TITLE: -
PBP Paresh	VKM	DRK	CHLORINATOR FOR CW SYSTEM

BHEL DOC NO. – PE-DC-226-174-A016	DOCUMENT NO. – BNC/A/1115/DS/06 (SHEET 1 OF 5)	REV. – R1

D/Ch-12

13 MAR 2006

3472A·610·B106·12 Rn

RECORD OF REVISIONS

Rev. No.	Date	Revised Sheets	Revised by	Approved by
R0	24/12/05	FOR APPROVAL		
R1	23/02/06	Submission for Client approval		

2.14.03	Cable lengths shall be considered in such a way that straight through cable joints are avoided.
2.14.04	Cables shall be armoured type if laid in switchyard area or directly buried.
3.00.00	**CONSTRUCTIONAL FEATURES**
3.01.00	**1.1 KV Grade Control Cables** Control Cables shall have stranded copper conductor multicore PVC insulated, PVC inner-sheathed, armoured / unarmoured, PVC outer-sheathed conforming to IS:1554. (Part-I).
3.02.00	**Cable Drums** (a) Cables shall be supplied in non returnable wooden or steel drums of heavy construction. The surface of the drum and the outer most cable layer shall be covered with water proof layer. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by 'U' nails so as to eliminate ingress of water during transportation, storage and erection. Wood preservative anti-termite treatment shall be applied to the entire drum. Wooden drums shall comply with IS : 10418. (b) Each drum shall carry manufacturer's name, purchaser's name, address and contract number, item number and type, size and length of cable and net gross weight stencilled on both the sides of the drum. A tag containing same information shall be attached to the leading end of the cable. An arrow and suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled.
4.00.00	**TESTS**
4.01.00	**GENERAL** 1.0 All equipments to be supplied shall be of type tested quality. The Contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last five years from the date of bid opening. These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

	2.0 In case the Contractor is not able to submit report of the type test(s) conducted within last five years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the Contractor shall conduct all such tests under this contract free of cost to the Owner and submit the reports for approval. 3.0 All acceptance and routine tests as specified below and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.
4.02.00	**TYPE TESTS:**
4.02.01	The Type tests reports for the following shall be submitted for one size each of LT control cable of each make : **S. No. Type Test** — **Remarks** a) **For Conductor** 1. Resistance test b) **For Armour Wires / Formed wires** 1. Measurement of Dimensions 2. Tensile Test 3. Elongation test 4. Torsion test — For round wire only 5. Winding test — For Formed wires 6. Resistance test 7. Zinc Coating test — For G.S. conductors only. c) **For PVC insulation & PVC Sheath** 1. Test for thickness 2. Tensile strength and elongation test before ageing and after ageing

	3.	Ageing in air oven	
	4.	Loss of mass test	For PVC insulation and sheath only
	5.	Hot deformation test	For PVC insulation and sheath only
	6.	Heat shock test	For PVC insulation and sheath only
	7.	Shrinkage test	
	8.	Thermal stability test	For PVC insulation and sheath only
	9.	Oxygen index test	For outer sheath only
	10.	Smoke density test	For outer sheath only
	11.	Acid gas generation test	For outer sheath only
	d)	**For completed cables**	
	1.	Insulation resistance test (Volume resistivity method)	
	2.	High voltage test	
	3.	Flammability test as per IEC - 332 Part-3 (Category-B)	
4.02.02	**Acceptance Tests** (as per QA table)		
4.03.00	**Routine Tests** (as per QA table)		

SECTION – D3
GENERAL TECHNICAL REQUIREMENT FOR C&I

1.0 SCOPE

This specification covers the Design, Manufacture, Inspection and Testing at the manufacturer's works, proper packing for transportation and delivery to site, supervision, erection, and commissioning at site of Local Panels required for control and monitoring of the Auxiliary Plant & Equipment.

2.0 CODES AND STANDARDS

2.1 All the equipments specified herein shall comply with the requirements of the latest issue of the relevant National and International standards.

2.2 As a minimum requirement, the following standards shall be complied with:

a) IS-6005 : 1998 : Code of practice for phosphating of iron and steel.
b) IS-5 : 2007 : Colors for ready mixed paints and enamels.
c) IS-1248:2003 : Direct Acting Indicating Analog Elec Measuring Instruments.
d) IS/IEC 60947:Part 1:2004 : Low Voltage switchgear & control gear: Part-I (General Rules)
e) IS-8828:1996 : Circuit breaker for household and similar installations.
f) IS-13947 (Part-I):1993 : Low Voltage switchgear & control gear : Part-I (General Rules)
g) ISA-18.1:1979 : Annunciator Sequences and Specification
h) NFPA-496:2003 : Purged & Pressurised Enclosure for Electrical Equipment in Hazardous Locations.

3.0 TECHNICAL REQUIREMENTS

3.1 Panel Construction

3.1.1 The local panels shall house the secondary instruments, annunciation system, Single loop controller, Control switches / push buttons, indicating lamps/LED cluster, relays, timers and other devices required for operation and monitoring of the equipment locally.

3.1.2 The panels shall be of free standing type either welded construction on angle iron (minimum section of 50 x 50 x 4 mm) structure or folded construction by sheet metal formation depending upon the equipments to be mounted on it. The panels shall be robustly built and stiffeners as necessary shall be provided.

3.1.3 The panel shall be suitably reinforced to ensure adequate support for all instruments mounted thereon. All welds on exposed panel surfaces shall be ground smooth.

3.1.4 The salient features of construction shall be:

Sheet material: Cold rolled sheet steel
Frame thickness: Not less than 3.0mm
Enclosure thickness: Not less than 2.5 mm for load bearing sections (Mounted with instruments)
1.6 mm for doors and Not less than 2.0 mm for others
Panel Height: Not less than 2365 mm
Gland plate thickness: 3.0mm
Base channel: ISMC 100 with anti-vibration mounting & foundation bolts.

3.1.5 The panel shall be provided with rear doors with integral lockable handle. The door when locked shall be held at minimum three places. The door width shall not be more than 550mm.The doors shall be provided with suitable stiffeners to prevent buckling. The handle shall be on the right side of the door. The door shall be removable type with concealed hinges to facilitate maintenance work. Suitable pocket inside the door shall be provided for keeping the drawings / documents. Double door shall be provided with suitable glass windows, as per the requirement.

3.1.6 Suitable neoprene gasket shall be provided on all doors and removable covers. Suitable ventilation system along with louvers shall be provided at bottom and top of the doors covered with removable wire mesh.

3.1.7 The class of protection shall be in accordance with IP-55 unless otherwise specified .

3.1.8 All steel surfaces shall be cleaned by sand / pellet blasting, treated for pickling, degreasing and phosphating etc. by seven tank method. The panel shall have a high quality finish and appearance. The panel shall be painted with two coats of primer followed by two coats of epoxy / synthetic enamel based final paint of color shade and finish as specified in the attached data sheet. Minimum thickness of the paint shall be 85 microns for external paint and 70 microns for internal paint.

3.1.9 The cable glands of the required size and type shall be supplied along with the Panel. Panel shall have gland plate at cable entry to panel.Thickness of gland plate shall not be less than 3mm.

3.1.10 All operable and indicating devices shall be mounted on the front of the panel while aux. Relays / timers MCBs etc. required for realization of control logics shall be mounted on a mounting plate inside the panel. Auxiliary relays and timers etc. shall be grouped according to the control function.

No operable or indicating devices shall be mounted below 750 mm and above 1800 mm (w.r.t. finished ground level). The devices shall be located in such a way so as to ensure easy access for operation / maintenance.

3.1.11 Dual control power supply feeders of voltage class as specified in data sheet-A (No. PES-145A-DS1-0) shall be provided by the purchaser. In case redundant power supply feeders are provided then auto changeover unit shall be mounted on the panel are in the panel supplier's scope. Alaram shall be provided against failure of a single power supply. Where DC control power supply is specified an additional 240V, 50 Hz AC supply feeder for powering of space heater and lighting shall be provided by the purchaser. Suitable arrangement shall be provided inside the panel to receive and terminate the power supply feeder(s). For this purpose MCBs of suitable current rating shall be provided by the vendor. A supervisory relay along with a pilot lamp to indicate control supply 'ON' shall be provided on the panel. Any other power supply required for the operation of the devices mounted in the panel shall be arranged by the vendor.

3.1.12 The internal wiring shall be carried out with 1100 volt grade PVC insulated copper multi strand wire / flexible of 1.5mm2 size. AC & DC wires shall be kept separate from each other. Separate coloured wires to be used for AC and DC circuits. All wires shall be properly numbered and identified with ferrules as per the Control scheme / wiring diagram. Wires shall be routed and run through PVC troughs/tray.

3.1.13 Terminal blocks shall be clip on type, 1100 volts grade. Separate terminal blocks shall be used for AC & DC circuits. The terminals shall be suitable for terminating 0.5 mm2 to 2.5mm2 external cables. The TB points in terminal block shall be cage clamp type / screw type. The terminal for ammeters shall be provided with removable links for shorting CTs. Each terminal strip shall be provided with identification strip. The terminal shall not be mounted below 250 mm height from finished floor. The panel shall have ten (20) percent spare terminal.

3.1.14 The interior of each panel shall be suitably illuminated through fluorescent lamps / tube lights with shrouded cover of minimum 15W operable on 240V 50 Hz AC power supply through panel door switch. A 5 Amp. 3-pin Power receptacle with plug shall be provided.

3.1.15 Suitable space heaters operable on 240 Volts 50 Hz AC power system with ON-OFF switch shall be provided at the panel bottom. These shall be designed to maintain the panel temperature five (5) deg. C above the ambient temperature during maintenance shutdown. Suitable isolating and control devices comprising of MCB, thermostat etc. shall be provided for the space heater.

3.1.16 The panel shall be provided with a copper earth bus of 25 x 6 mm size running throughout the width of the panel. It shall be terminated internally with 10 mm bolts at extreme ends for connection to; main station earth. The panel mounted equipments / devices shall be connected to earth bus through green coloured PVC insulated stranded copper conductor of 2.5 mm2 size.

3.1.17 Local Panel shall be provided with main name plate of 150 mm x 40 mm size having inscription of 20 mm height. The individual devices on the panels shall be as provided with separate name plate with inscription of 3 mm height. The instrument / devices shall be provided with stick on label plates inside the panel. The material of the main and individual labels shall be three (3) ply 3 mm thick Traffolyte Sheet / 2 mm Anodised Aluminium Plate. The material shall be laminated phenolic, The inscription shall

be with white letters on black background on traffolyte sheet. The labels shall be fixed by self tapping non-rusting screws. The nameplates for panels /consoles shall be provided both on the front and the rear.

3.1.18 Vendor shall furnish electric load and heat load list (in case panel is to be placed in ac environment) of each panel.

3.2 Hazardous Area Panel Requirement

3.2.1 The Local Panel located in hazardous area shall be pressurized as per NFPA-496 requirements to render it non-hazardous. Alarms shall be provided for local and remote annunciation when pressurisation falls below 2.5 mm of water column. Protection shall be of type Z of NFPA-496. It shall not be possible to switch ON the power of purged section unless it is purged as per the recommendation of NFPA-496. Vendor must provide a protective device on the panel to protect the panel from over pressurisation.

3.2.2 Vendor shall supply pressurisation kit consisting of valves, restriction orifices, dual filter regulation, pressure gauges, pressure switches, rotameter etc. Pressurisation kit shall be surface mounting on a metal board and located outside the local panel. Pressurisation kit shall further consist of solenoid valve flow switch, timer blow off safety device etc., so as to make purging fully automatic. However final start shall be manual. Panel protection against over pressure to be provided as per NFPA-496.

3.2.3 Pressurised local control panel pressurization kit assembly design shall provide minimum leakage flow through the Local Control Panel. Panel venting shall be as per NFPA-496.

3.2.4 All components in the local panel like indicating instruments, push buttons switches, lamps etc., which are required to be energized without panel pressurization or before completion of purge cycle shall be explosion proof as per NEMA-7 & suitable for area classification.

3.2.5 All push buttons etc. requiring frequent operation during machine running shall have good positive sealing. Weatherproof housing or cover to be provided wherever necessary. Vendor shall provide pressurisation bypass switch outside explosion proof enclosure of pressurized panel with lamp indication. This shall be used only during maintenance. All hinges, screws, other non-painted metallic parts shall be of stainless steel material.

3.2.6 Provision to switch off manually all types of power shall be provided in the panel. In addition, it shall also be possible to switch off power circuits / components which are powered from motor control centre or control room manually in case of pressurization failure. All such cables from MCC and main control room shall be terminated in explosion proof boxes (NEMA-7).

3.3 Control & Monitoring devices

3.3.1 Instruments like Indicators, recorders, single loop controllers etc. as applicable and specified elsewhere for the plant / equipment shall be supplied and mounted on the panel.

3.3.2 Alarm Annunciator System

It shall be solid state discrete facia type having a sequence of ISA-S18.1A or as specified, opaque facia windows of 70 mm x 50 mm size, having two (2) lamps per window, and hooter of 10W, and provision for repeat group alarm at remote. The annunciator shall be provided with ten (10) percent spare windows or minimum two (2) windows along with electronics.

3.3.3 Relays

The relays shall be electromagnetic type suitable for specified control supply. Its contact configuration and rating shall be suitable for the specified control function. However minimum contact rating shall be 5 Amp AC & 2 Amp DC as applicable. There shall be ten (10) percent spare contacts.

3.3.4 Timers

The timers shall be electronic type suitable for specified control supply. Its contact configuration and rating shall be suitable for the specified control function. However, minimum contact rating shall be 5 Amp AC & 2 Amp DC as applicable.

3.3.5 Control / Selector Switches

Switches shall be Rotary Cam type with minimum of 5 Amps AC & 2 Amp DC continuous current rating. Selector switches shall be stay put type while control switches shall be spring-return-to-neutral type. Contact configuration and rating shall be as per the control function requirement. The switches shall be lockable type wherever specified. Each switch shall be provided with engraved plates indicating the switch position / functions.

3.3.6 Push Buttons / Indicating Lights

The push buttons shall be momentary action self-resetting type, however stop P.B. for unidirectional drives shall be provided with manual reset facility. Its contact configuration & rating shall be as required for the control function but minimum 2 NO + 2 NC of 5 Amp. AC rating. It shall have round coloured projecting tab and engraved escutcheon plate / inscription plate. Colour coding of push buttons shall be as under:

RED	Motor OFF / Valve CLOSE	YELLOW	Alarm acknowledge	Left Hand Side
GREEN	Motor ON / Valve OPEN	BLACK	Lamp test	Right Hand Side

Indicating lights shall be suitable for direct connections across specified power supplies. It shall be fitted with built in resistance to prevent circuit tripping on shorting of lamp filament. It shall be fitted with LED cluster type lamp replaceable from front.

GREEN	Motor OFF / Valve CLOSED condition	AMBER	Motor tripped	Left Hand Side
RED	Motor ON / Valve OPEN condition	WHITE	Normal / healthy	Right Hand Side

3.3.7 Ammeters

Ammeter shall be 96 x 96 mm size, 90 deg. deflection, 1.5% accuracy, 1 Amp. CT operated or with 4-20mA input and Flush mounting type as called for in the data sheet-A (No. PES-145-54A-DS1-0). Ammeters for motors shall have six (6) times folded scale at upper end to enable motor starting current indication

3.3.8 Miniature Circuit Breaker (MCB)

These shall be instantaneous magnetic trip type for short circuit in addition to current time inverse delayed thermal trip feature for over current protection. The housing of MCB shall be made of non-ignitable, high impact material. It shall have minimum short circuit rating of 9 KA for AC Voltages and 4 KA for DC Voltages.

3.3.9 Makes of various instruments / devices shall be as given below

1.	Alarm Annunciators	:	Procon / IIC
2.	Ammeters	:	AEP / IMP
3.	Control / Selector Switches	:	Alsthom / Kaycee / Siemens / L&T
4.	Push Buttons / Indicating Lamps	:	Siemens / L&T / Teknic / Alsthom
5.	Auxiliary Relays	:	Jyoti / Siemens / L&T / OEN
6.	Timers	:	L&T / Alsthom / Bhartiya Cutler Hammer
7.	MCBs	:	S&S Power Engg. / Indo Asian / MDS
8.	Terminal Blocks	:	Jyoti / Elmex

4.0 TESTING AND INSPECTION

4.1 The bidder shall adopt suitable quality assurance program to ensure that the equipments offered will meet the specification requirements in full.

4.2 BHEL's standard Quality Plan for LCP is enclosed with the specification. The bidder shall furnish his acceptance to BHEL's QP and submit the signed and stamped copy of QP along with the offer.

4.3 The vendor shall conduct the following tests as a minimum requirement:

4.3.1 Routine Tests

1. High Voltage (H.V.)
2. Insulation Resistance (I.R.)
3. Functional

4.3.2 Type Tests

1. Enclosure Class Test

5.0 SPARES AND CONSUMABLES

5.1 Commissioning Spares and consumables

The bidder shall supply all commissioning spares and consumables 'as required' during Start-up, as part of the main equipment supply.

5.2. Mandatory Spares

The bidder shall offer alongwith main offer, the Mandatory Spares as specified elsewhere in the specification. The Mandatory Spares offered shall be of the same make and type as the main equipment.

5.3. Recommended Spares

The bidder shall furnish a list of Recommended Spares indicating the normal service expectancy period and frequency of replacement; quantities recommended for 3 years operation alongwith unit rate against each item to enable BHEL/BHEL's Customer to place a separate order later, if required.

6.0 DRAWINGS AND DOCUMENTS

6.1 The bidder shall furnish the following documents in required number of copies along with the bid :

1. Data Sheet no. PES-145A-DS1-0
2. General Arrangement Drawing.
3. Catalogue and technical information for instruments and devices.
4. Quality Plan.

6.2 The vendor shall furnish the following documents in required number as agreed after the award of contract:

1. Data Shee No. PES-145A-DS2-0
2. GA Drawing indicating layout of instruments, construction details, foundation details, cable gland plate alongwith cable glands and all details mentioned in this specification.
3. Control Schematic Diagram along with grouping of different terminals for various functions.
4. Catalogue and technical information for instruments and devices with selected options clearly marked.
5. O&M Manuals.
6. "As Built" Drawing.
7. CDs.

7.0 MARKING AND PACKING

7.1 Panel with all instruments / devices mounted on it shall be suitably packed & protected for the entire period of despatch, storage and erection against impact, abrasion, corrossion, incidental damage due to vermin, sunlight, high temperature, rain moisture, humidity, dust, sea-water spray (where applicable) as well as rough handling and delays in Transit and storage in open.

8.0 APPLICABLE DATA SHEET FORMS

This document shall be read with one or more of the following data sheet forms :

- Data sheet A&B for Local Panels : Data sheet no. PES-145A-DS1-0
- Data sheet C for Local Panels : Data sheet no. PES-145A-DS2-0

RECORD OF REVISIONS

Rev. No.	Date	Revision Details	Revised by	Approved by
R0	05/04/06	FOR APPROVAL		

TECHNICAL DATA SHEET

BANACO BABUBHAI NAROTAMDAS & CO. BANACO House, P-1 Cama Ind Estate, Walbhat Road, Goregaon (E), Mumbai - 400 063 Phone: 2685 1386, 5699 7530 Fax: 022-2685 21	DOC NO : BNC/A/1115/DS/40-01 REV NO : R0 DATE : 5/4/2006 DESCRIPTION : **PRESSURE SWITCHES** SHEET NO. : 3 of 5
BHEL DOC NO :PE-DC-226-174-A053	
P&I DIAGRAM NO.	: **BNC/4472 & 4473**

1.0	Make	: INDFOSS
2.0	Type	: Bellows, piston actuated, blind type Diaphragm protected for corrosive application
3.0	Service	: For CW & RW Chlorination system
4.0	Mounting	: DIRECT/Field
5.0	Accuracy	: +/-1% of span
6.0	Repeatability	: +/-0.5% of F.S.R
7.0	Switch type	: Contact System (Auto Reset)
	Contact type/Rating	: 1 DPDT@10A at 240VAC
8.0	Switch differential	: Adjustable.
9.0	Set Point	: Adjustable.
10.0	Set Pressure	: External Adjustable over entire range With Seal Cap for locked setting
11.0	SETTER SCALE	: Black Graduation with white liner Scale with red printed
12.0	Enclosure protection	: Weather proof ~~upto~~ IP:66 of IS :2147
	Housing material	: Die-cast Aluminium casing Epoxy painted
13.0	Case colour/finish	: Grey
14.0	**Sensing Element**	: SS-304 bellows with SS316 wetted parts For RT-117 (SS Bellows Brass wetted Part)
15.0	Process connection location	: Bottom
16.0	Conduit size	: 3/4" NTP(F)
17.0	Process connection size	: 1/2" NPT (M)
	ACCESSORIES	
18.0	**CHEMICAL SEAL (For Chlorine & Caustic)**	
18.1	Make	: BANACO
18.2	Top chamber	: SA 105
18.3	Bottom Chamber	: SA 105
18.4	Sensing	
	For Chlorine liquid & GasServices	: Silver Diaphram transmitting the pressure to the bourdon tube through anti-corrosive sealing fluid (Silicon Oil)
	For Caustic Services	: AISI 316 Diaphram transmitting the pressure to the bourdon tube through anti-corrosive sealing fluid (Silicon Oil)
19.0	Pressure Snubber for Pump discharge	:
20.0	**Tests**	: As per approved QAP
21.0	**Catalogue**	: Attached

TECHNICAL DATA SHEET

BANACO
BABUBHAI NAROTAMDAS & CO.
BANACO House, P-1 Cama Ind Estate,
Walbhat Road, Goregaon (E), Mumbai - 400 063
Phone: 2685 1386, 5699 7530 Fax: 022-2685 2182

DOC NO	BNC/A/1115/DS/40-01
REV NO	R0
DATE	5/4/2006
DESCRIPTION	PRESSURE SWITCHES
SHEET NO.	4 of 5

BHEL DOC NO :PE-DC-226-174-A053

P&I DIAGRAM NO. : BNC/4472 & 4473

PRESSURE SWITCHES FOR CW & RW CHLORINATION SYSTEM

CW CHLORINATION SYSTEM

SR NO	TAG NO	QTY (Nos)	MODEL	RANGE		Max. Process Pressure	Set Pressure	SERVICE	SEAL MATERIAL & TYPE OF SEAL
				Process (Kg/Sq.Cm)	Instrument (Kg/Sq.Cm)	(Kg/Sq.Cm)	(Kg/Sq.Cm)		
1	PS-1,PS-2 & PS-5	3	RT 117(SB) D ADC	0-10	10 TO 30	28	15	Liquid Chlorine	Silver, Diaphragm type
2	PS-3 & PS-4	2	RT 200 SS6 D ADC	0-10	0.2 to 6	10	1	Liquid Chlorine	Silver, Diaphragm type
3	PS-6 & PS-7	2	RT 117(SB) D ADC	0-10	10 TO 30	28	25	Gas Chlorine	Silver, Diaphragm type
4	PS8 & PS-9	2	RT 117(SB) D ADC	0-10	10 TO 30	28	15	Gas Chlorine	Silver, Diaphragm type
5	PS-10	1	RT-116 SS6 D ADC	0-5	1 to 10	5	5.5	Water	NA
6	PS-11	1	RT-116 SS6 D ADC	0-5	1 to 10	5	4	Water	NA
6	PS-12	1	RT 200 SS6 D ADC	0-2	0.2 to 6	2	1.5	Water	NA
7	VS-1 & VS-2	2	RT 121 SS6 D ADC ADS	-600 mm of Hg	-750 to 0 mm Hg	-650 mm of Hg	-700 mm of Hg	Gas Chlorine	Silver, Diaphragm type
8	VS-3 & VS-4	2	RT 121 SS6 D ADC ADS	-600 mm of Hg	-750 to 0 mm Hg	-700 mm of Hg	-300 mm of Hg	Gas Chlorine	Silver, Diaphragm type

RW CHLORINATION SYSTEM

SR NO	TAG NO	QTY (Nos)	MODEL	RANGE		Max. Process Pressure	Set Pressure	SERVICE	SEAL MATERIAL & TYPE OF SEAL
				Process (Kg/Sq.Cm)	Instrument (Kg/Sq.Cm)	(Kg/Sq.Cm)	(Kg/Sq.Cm)		
1	PS-13	1	RT 200 SS6 D ADC	0-10	0.2 to 6	10	1	Gas Chlorine	Silver, Diaphragm type
2	PS-14	1	RT-116 SS6 D ADC	0-5	1 to 10	5	5.5	Water	NA
3	PS-15	1	RT-116 SS6 D ADC	0-5	1 to 10	5	4	Water	NA
4	PS-16	1	RT 200 SS6 D ADC	0-2	0.2 to 6	2	1.5	Water	NA

TECHNICAL DATA SHEET

BANACO
BABUBHAI NAROTAMDAS & CO.
BANACO House, P-1 Cama Ind Estate,
Walbhat Road, Goregaon (E), Mumbai - 400 063
Phone: 2685 1386, 5699 7530 Fax: 022-2685 2182

DOC NO	BNC/A/1115/DS/40-01
REV NO	R0
DATE	5/4/2006
DESCRIPTION	LEVEL SWITCHES (Pressure switches)
SHEET NO.	5 of 5

BHEL DOC NO :PE-DC-226-174-A053

P&I DIAGRAM NO. : BNC/4472

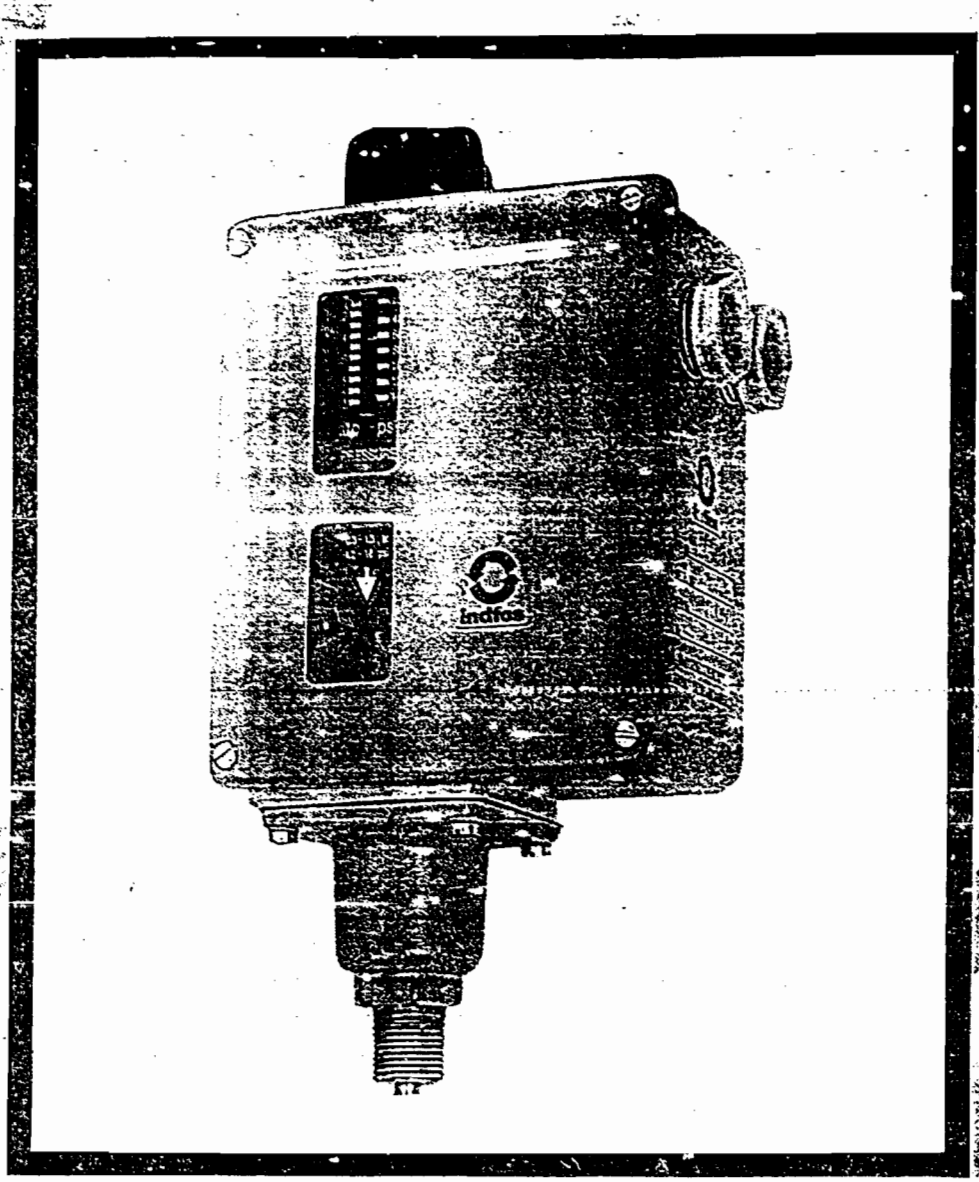
1.0	Make & Model	:	INDFOSS, RT 113 D ADC
2.0	Type	:	Bellows, piston actuated, blind type Diaphragm protected
3.0	Service	:	For Evaporator Make - up water CW Chlorination system
4.0	Mounting	:	DIRECT/Field
5.0	Accuracy	:	+/-1% of span
6.0	Repeatability	:	+/-0.5% of F.S.R
7.0	Switch type	:	Contact System (Auto Reset)
	Contact type/Rating	:	1 DPDT@10A at 240VAC
8.0	Switch differential	:	Adjustable.
9.0	Set Point	:	Adjustable.
10.0	Set Pressure	:	External Adjustable over entire range With Seal Cap for locked setting
11.0	SETTER SCALE	:	Black Graduation with white liner Scale with red printed
12.0	Enclosure protection	:	Weather proof upto IP:66 of IS :2147
	Housing material	:	Die-cast Aluminium casing
13.0	Case colour/finish	:	Grey
14.0	Sensing Element	:	Neoprene rubber diaphragm, Zinc plated, Chrome passivated MS Flange
15.0	Process connection location	:	Bottom
16.0	Conduit size	:	3/4" NTP(F)
17.0	Process connection size	:	1/2" NPT (M)

SR NO	TAG NO	QTY (Nos)	MODEL	Range		Min/ Max Level	SERVICE
				Process (cm of Water)	Instrument (cm of Water)	(cm of Water)	
1	LS-1 & LS-2	2	RT 113 D ADC	60	0-300	55	Water
2	WLC-1 & WLC-2	2	RT 113 D ADC	100 - 112	0-300	100 -112	Water

18.0 **Tests** : As per approved QAP

19.0 **Catalogue** : Attached

PRESSURE & TEMPERATURE SWITCHES TYPE RT



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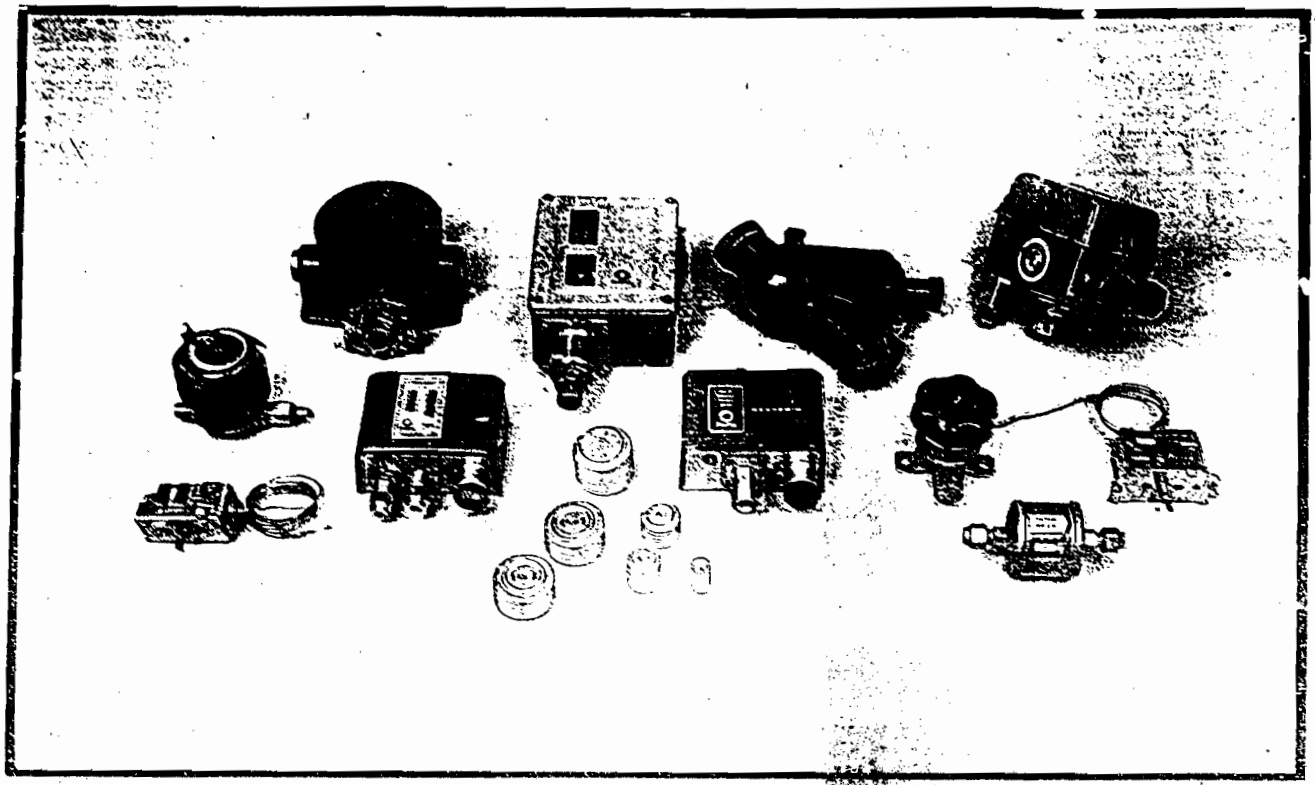

Indfos

INDFOS INDUSTRIES LIMITED

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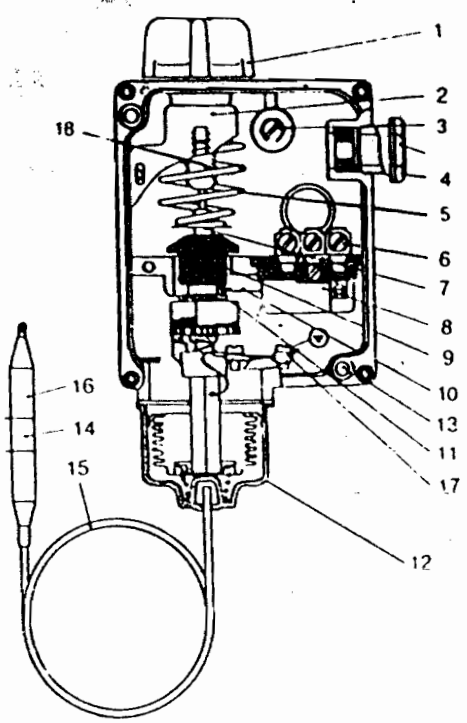
AUTHORISED DEALER

TEMPERATURE SWITCHES

RT Series of temperature switches have a vapour filled thermostatic element. The thermostatic element consists of sensing bulb, capillary tube and a bellows element. The entire element contains a charge which reacts to temperature variations at the sensing bulb, so that pressure on the bellows increases on rising temperature. The bellows movement due to this increase in pressure is utilised to operate the switch. Available in various ranges to control temperature upto 300°C. RT temperature switches are available with a selection of capillary lengths. The vapour filled system features small bulb sizes making installation easy.

All models feature ± 1% repeatability with high over-temperature limits.

Wherever, bulb of temperature switch is exposed to pressuer, corrosive fluid or high velocity, a thermowell must be used. Threaded, or flanged thermowells, with length and materials as per application requirement are available. The standard model is weather proof to IP:66. For use in hazardous areas, these switches are supplied in explosion proof version certified by CMRS for use in gas groups, IIA & IIB.



RT temperature switches have already proved reliable in various applications in:

- Diesel Locomotives
- Power Plants
- Chemical Plants
- Petrochemical Plants
- Fertilizer Plants
- Steel Mills

1. Knob
2. Range scale
3. Loop terminal
4. Cable entry
5. Main spring
6. Connection terminals
7. Main spindle
8. Switch
9. Upper guide bush
10. Contact arm
11. Differential setting roll
12. Bellows element
13. Mounting hole
14. Sensor clip
15. Capillary tube
16. Sensor
17. Earth screw
18. Setting spindle

MODELS/RANGES

TYPE	CAPILLARY LENGTH METERS	CODE	RANGE°C	1) DIFFERENTIAL	MAXIMUM PERMISSIBLE TEMP. °C	CHARGE TYPE
RT - 101	3	17-5127	25 - 90	2.4 - 10 3.5 - 20	300	Adsorption 2) charge
	5	17-5128				
	8	17-5129				
RT - 107	3	17-5167	70 - 150	6 - 25 1.8 - 8	215	Partial vapour 3) charge
	5	17-5168				
	8	17-5169				
RT - 120	5	17-5209	120-215	7 - 30 1.8 - 9	260	
RT - 123	5	17-5222	150 - 250	6.5 - 30 1.8 - 9	300	
RT - 124	5	17-5229	200 - 300	5 - 25 2.5 - 10	350	

1) Differential values indicated are at min. and max. range. For exact differential at particular setting refer nomogram on page 6.

2) RT-101 has an adsorption charge. The sensing bulb can be placed in fluids at temperatures higher or lower than rest of thermostatic element. No ambient temperature compensation is required as per Sama class II.

3) Partial charge is used where range is higher than ambient temperature.

INSTALLATION

MOUNTING

RT pressure switches can be mounted with the help of mounting screws provided with every switch. The mounting screws pass through the two mounting holes provided across the body of the pressure switch.

RT pressure switches can be installed directly also, with the help of process connection threads.

RT temperature switches are remote mounted and can be similarly installed as pressure switches with the help of mounting screws.

IMPORTANT :- When tightening control to pressure line, always use wrench flats on hex provided on the pressure element.

RT pressure and temperature switches can be mounted in any position. However, if severe vibrations are present in the vertical plane it is always advantageous to mount the switches with the cable entries pointing downwards.

In steam plants use a water filled damping coil between the element and the steam chamber to prevent the bellows from getting too hot.

In reciprocating pumps, pressure control should not be installed close to the pump to avoid pulsations which can damage the sensing element. Wherever pulsations are present, a damping coil must be used.

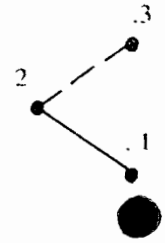
THERMOWELLS

For temperature switches used along with thermowells, heat conduction compound must be filled between sensing bulb and thermowell inner wall. This compound fills the air gap present and improves heat conductivity.

ELECTRICAL CONNECTIONS

Each switch has one no. SPDT contact having the following markings

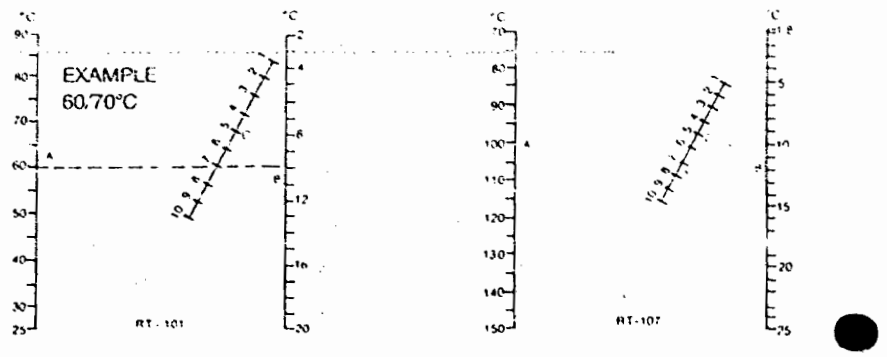
NORMALLY CLOSED-1
COMMON - 2
NORMALLY OPEN - 3

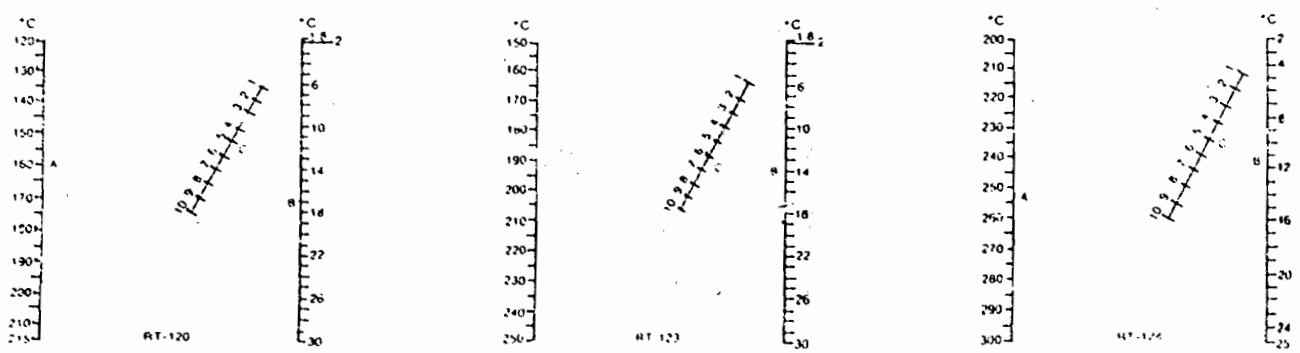


NOMOGRAMS

Nomograms are used to adjust differentials.
EXAMPLE : Temperature switch is desired with settings at 60°C and 70°C. Differential required is 70-60=10°C.

Draw a line joining 60°C (lower setting) on range scale and 10°C on the differential scale. Note the point where the line intersects the differential scale setting knob. Set the switch to 60°C with the setting knob. Adjust differential knob to position. Settings at 60°C and 70°C achieved





For accurate setting, temperature switches should be set in water/oil bath with the help of a callibrated thermometer/temperature gauge.

C.E./ THERMAL DESIGN, PSEB, PATIALA

VENDOR DOCUMENTS REVIEW STATUS

1. Copies of final distribution.
2. Approved.
3. Approved except as noted. Forward final drgs. (Proceed for manufacture/construction parallely)
4. Approved except as noted rectification. Resubmission is required.
5. Not approved. See accompanying letter.
6. For information and record only.

Refer Memo No. MD.....Date.....

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TCE CONSULTING ENGINEERS LTD.

VENDOR DOCUMENT REVIEW STATUS

- ☐ A. Drawing approved as submitted: proceed with fabrication/construction.
- ☐ B. Drawing approved subject to comments noted proceed with fabrication/Construction considering our comments.
- ☐ C. Our comments are noted on this marked up print
- ☐ D. Our comments are noted in memo attached to the forwarding transmittal letter No. 619-VDT/05 Dated..... 04/05/06
- ☐ E. Correct original of this drawing to reflect our comments and resubmit for approval.
- ☐ F. Correct original of this drawing to reflect our comments and resubmit for records.
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Reviewed by ..... Date 04/05/06

CHECKED	RECOMMENDED	APPROVED
ADDL.	OWNER:	DIR/MECH

	PUNJAB STATE ELECTRICITY BOARD PATIALA
PROJECT:	2 X 250MW GHTP LEHRA MOHABBAT THERMAL POWER PROJECT STAGE – II, UNITS 3 & 4
OWNER'S CONSULTANT:	TCE CONSULTING ENGINEERS LIMITED BANGALORE
CONTRACTOR:	BHARAT HEAVY ELECTRICALS LTD. POWER SECTOR PROJECT ENGINEERING MANAGEMENT- NEW DELHI
ENGINEERING SUB CONTRACTOR:-	FICHTNER CONSULTING ENGINEERS(INDIA) PVT. LTD. CHENNAI.
VENDOR	BABUBHAI NAROTTAMDAS & CO. 'BANACO HOUSE' P-1, CAMA INDUSTRIAL ESTATE, WALBHAT ROAD, GOREGAON (EAST), MUMBAI - 400063

Prepared by	Checked by	Approved by	TITLE: -
PBP	VKM	DRK	LOAD INDICATOR FOR CW & RW CHLORINATION SYSTEM.

BHEL DOC NO. –	DOCUMENT NO. –	REV. –
PE-DC-226-174-A037	BNC/A/1115/DS/27 (SHEET 1 OF 3)	R0

F 2 MAY 2006

3472A·619·B106·42Rd

RECORD OF REVISIONS

Rev. No.	Date	Revision Details	Revised by	Approved by
R0	05/04/06	FCR APPROVAL		

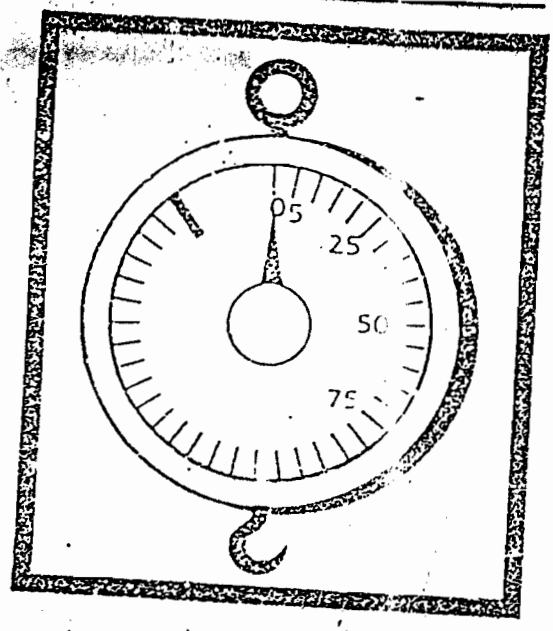
TECHNICAL DATA SHEET

BANACO BABUBHAI NAROTAMDAS & CO. BANACO House, P-1 Cama Ind Estate, Walbhat Road, Goregaon (E), Mumbai - 400 063 Phone: 2685 1386,5699 7530/31 Fax:2685 2182	**DOC NO** : BNC/A/1115/DS/27 **REV NO** : R0 **DATE** : 5/4/2006 **DESCRIPTION** : **Load Indicator** **(CW & RW CHLORINATION SYSTEM**
BHEL DOC NO :PE-DC-226-174-A037	**SHEET NO.** : 3 of 3
P&I DIAGRAM NO.	: **BNC/4382 & 4383**

1.0	Make	: Premier
2.0	QTY	: 2 Nos (1 No for CW & 1 No. for RW)
3.0	Type	: Dial type mechanical springless crane scale with compensating double pendulums
4.0	Application	: For Chlorine Tonner Weighing
5 0	Capacity	: 3000 Kgs
6.0	Body Material	: Mild Steel
7.0	Weight	: 80 KG
8.0	Dimension	: 600MM x 400MM x 150MM Depth
9.0	Least count & Accuracy	: 5Kg +/- 1Kg
10.0	Approval	: Certificate of verification from Indian controller of weights & measures.
11.0	Catalogue	: Attached

Premier

Engineering Works



DIAL TYPE
CRANE WEIGHER
500 KG TO 5000 KG

SALIENT FEATURES

The scale is built on a roburst steel base combining rigidity with accuracy keeping in view the up to date construction and easy operation. Still it is sensitive enough to produce accurate weighing and has independent movement for work. The lever machanism lends the machine necessary sensibility to reverse direction automatically at the exact moment when the loads come on the HOOK. The whole of the DIAL mechanism is enclosed in a fabricated steel base.

DIMENSION : 600mm x 400 mm x 150mm depth.
Resolution : 5 Kg.
Accuracy : ±,1 Kg.
Approval : Indian Controller of weights & measures.
Wt. : 80 Kg Approx

C.E./ THERMAL DESIGN, PSEB, PATIALA

VENDOR DOCUMENTS REVIEW STATUS

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Refer Memo No. MD.....Date.....

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SIGNED	RECOMMENDED	APPROVED
AD/MD-I	DD/MD-I	DIR/MECH

TCE CONSULTING ENGINEERS LTD.

VENDOR DOCUMENT REVIEW STATUS

- [x] A. Drawing approved as submitted: proceed with fabrication/construction.
- [ ] B. Drawing approved subject to comments noted proceed with fabrication/Construction considering our comments.
- [ ] C. Our comments are noted on this marked up print.
- [ ] D. Our comments are noted in memo attached to the forwarding transmittal letter No. TCE 3472A-IC-VDT/268 Dated 09.05.06
- [ ] E. Correct original of this drawing to reflect our comments and resubmit for approval.
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Reviewed by Verma Date 09.05.06

OWNER:	PUNJAB STATE ELECTRICITY BOARD PATIALA
PROJECT:	2 X 250MW GHTP LEHRA MOHABBAT THERMAL POWER PROJECT STAGE – II, UNITS 3 & 4
OWNER'S CONSULTANT:	TCE CONSULTING ENGINEERS LIMITED BANGALORE
CONTRACTOR:	BHARAT HEAVY ELECTRICALS LTD. POWER SECTOR PROJECT ENGINEERING MANAGEMENT- NEW DELHI
ENGINEERING SUB CONTRACTOR:-	FICHTNER CONSULTING ENGINEERS(INDIA) PVT. LTD. CHENNAI.
VENDOR	BABUBHAI NAROTTAMDAS & CO. 'BANACO HOUSE' P-1, CAMA INDUSTRIAL ESTATE, WALBHAT ROAD, GOREGAON (EAST), MUMBAI - 400063

Prepared by	Checked by	Approved by	TITLE: -
PBP	VKM	DRK	BYEPASS WATER ROTAMETER

BHEL DOC NO. –	DOCUMENT NO. –	REV. –
PE-DC-226-174-A059	BNC/A/1115/DS/40-07 (SHEET 1 OF 3)	R0

3472A·619·B106·34 R0

RECORD OF REVISIONS

Rev. No.	Date	Revision Details	Revised by	Approved by
R0	05/04/06	FOR APPROVAL		

TECHNICAL DATA SHEET

BANACO	DOC NO	BNC/A/1115/DS/40-07
BABUBHAI NAROTAMDAS & CO.	REV NO	R0
BANACO House, P-1 Cama Ind Estate,	DATE	5/4/2006
Walbhat Road, Goregaon (E), Mumbai - 400 063	DESCRIPTION	**ByePass Water Rotameter for CW & RW System**
Phone: 2685 1386, 5699 7530 Fax: 022-2685 2182		
BHEL DOC NO :PE-DC-226-174-A059	SHEET NO.	3 of 3

P&I DIAGRAM NO. : BNC/4472 & 4473

1.0	Make	:	Eureka Industrial Equipments Pvt. Ltd.	
2.0	Model No.	:	BPC-MS-150-3	BPS-MS-80-3
3.0	Quantity	:	1 No	1 No
4.0	Line Size	:	150 NB	80 NB
5.0	Scale Graduation	:	Cu.m/hr	Cu.m/hr
6.0	Scale Length	:	175-200mm	175-200mm
7.0	Direction of flow	:	Horizontal	Horizontal
8.0	Type	:	Glass Tube Rotamter	Glass Tube Rotamter
9.0	Function	:	Flow Indicator	Flow Indicator
10.0	Service	:	CW Ejector water Header pipe.	RW Ejector water Header pipe.
11.0	Fluid	:	Water	Water
12.0	Specific Gravity	:	1.0	1.0
13.0	Measuring Range	:	24-120Cu.m/hr (For 150NB)	3.2-16Cu.m/hr (For 80NB)
14.0	Operating Pressure	:	5.0 kg/Sq.Cm(g)	5.0 kg/Sq.Cm(g)
15.0	Operating Temperature	:	Ambient	Ambient
16.0	Rangeability	:	5:1	5:1
17.0	Accuracy	:	+/- 2% of Max. Flo	+/- 2% of Max. Flow
18.0	Repeatability	:	+/- 0.5% of Span.	+/- 0.5% of Span.
19.0	Differential Pr.Across orifice	:	4700 mm H2O at Max Flow.	4700 mm H2O at Max Flow.

20.0 **Material of construction**

a). Float	:	SS 316
b). Measuring Tube	:	Borosilicate Glass
c). Wetted Parts	:	Mild Steel
d). Gland Packings	:	PTFE + Necprene
e). Float Retainers	:	Stainless Steel
f). Scale	:	Aluminium Anodised
g).Orifice Plate	:	Ebonite
h).Carrier Ring	:	Mild Steel
I).Gaskets	:	PTFE
j).Isolating Valves	:	Mild Steel

21.0 Testing : As per Approved QAP

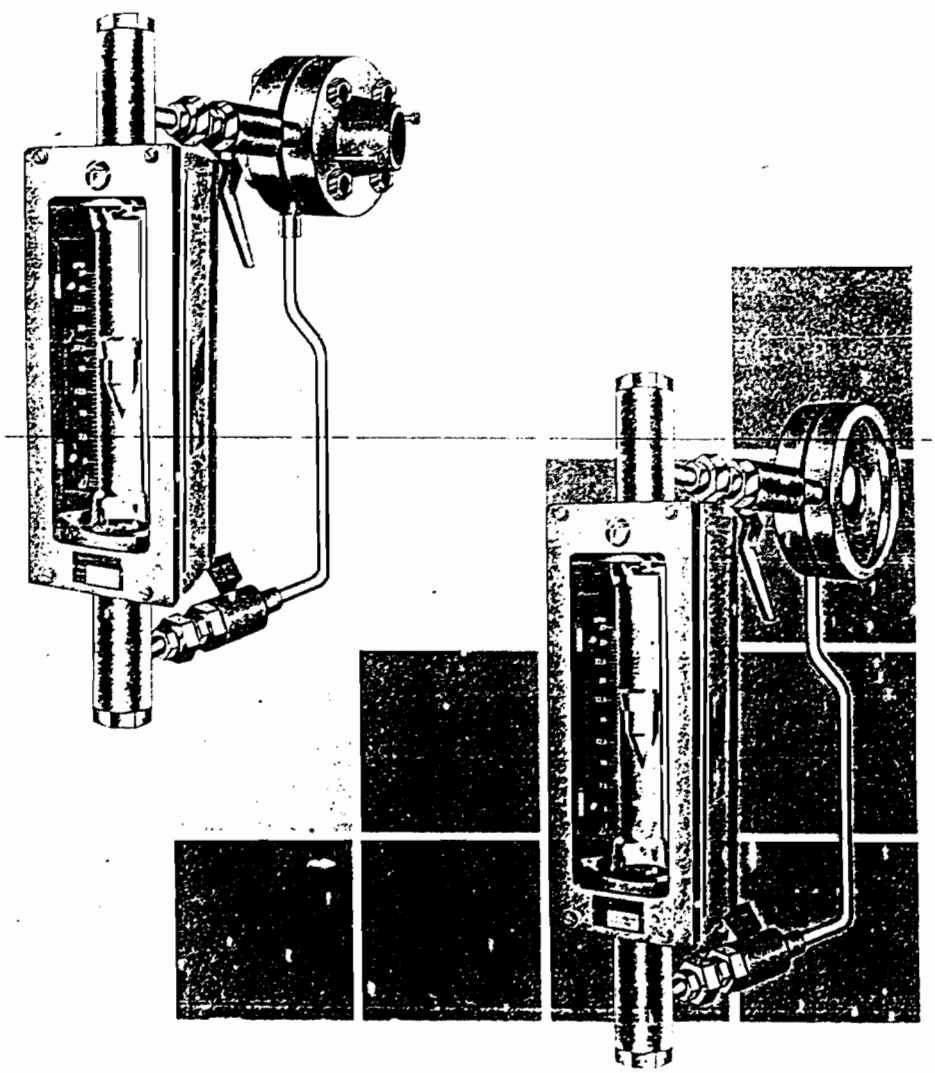
22.0 Catalogue : Attached

EUREKA

TÜV EN ISO 9001
RWTÜV

BYE PASS ROTAMETER

For reliable flow rate indication



EUREKA
INDUSTRIAL EQUIPMENTS
PVT. LTD.

SALES & REGD. OFFICE :
Royal Chambers, Paud Road, Pune : 411 038. India.
Tel.: +91-20-5443079 / 5441323.
Fax : +91-20-5438282
Email : eurekapnmail@vsnl.net
Internet : http://www.aswebplus.com/eureka

FACTORY :
Unit - I
136, 'S' Block, MIDC, Bhosari,
Pune : 411026.
Tel.: 7120514, 7120314.
Fax : +91-20-7120761.

Unit - II
501, 'J' Block,
MIDC, Pimpri,
Pune : 411018.
Tel : 7479786

MUMBAI OFFICE :
258,
Kalandas Udyog Bhavan,
Prabhadevi,
Mumbai - 400025.
Tel.: 4229069, 4310865.

BYE PASS ROTAMETER

Eureka Bye Pass Rotameters are suitable for flowrate measurement in 1" NB or higher size pipes. The complete assembly consists of carrier rings, bye pass line and a Rotameter as indicator. Isolating valves are provided on request. The Orifice plate dimensions are based on BS / ISO specification. The instrument is simple in construction and reliable in flow rate indication.

MATERIALS OF CONSTRUCTION

Orifice Plate	:	316 SS / Ebonite / Haste Alloy 'C'
Carrier Rings	:	316 SS / Mild Steel / C.S.
Pipe Line	:	316 SS / Mild Steel / C.S.
Wetted Parts Of The Rotameter	:	316 SS / Mild Steel / C.S. or Rubber Lined Steel / PTFE Lined Steel.

PERFORMANCE

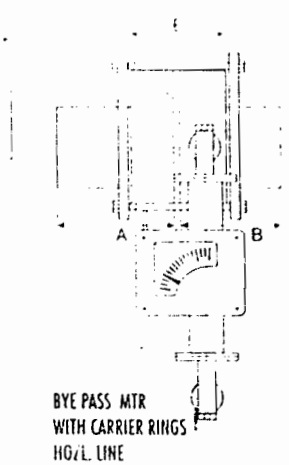
Type of tappings	:	Corner tapping (carrier ring), Flange tapping, D and D/2 tapping
Accuracy	:	± 2 % of full flow
Rangeability	:	7:1 or 5:1 10:1 on request.
Accessories	:	High & Low flow alarms.

Metal tube Bye Pass rotameters are available for special applications.

STANDARD RANGE FOR WATER AT 20°C

NW	MAXIMUM FLOWRATE (M3/HR)	NW	MAXIMUM FLOWRATE (M3/HR)
25	5	225	450
40	10	250	550
50	20	275	650
80	36	300	800
100	80	350	1000
125	125	400	1200
150	150	-----	-----
200	320	-----	-----

BYE PASS GTR WITH CARRIER RINGS HOZL LINE



BYE PASS MTR WITH CARRIER RINGS HOZL LINE

CARRIER RING DIMENSIONS

NW	E	NW	E
25	32	225	
40	46	250	
50		275	58
80		300	
100		350	
125	58	400	75
150			
200			

MINIMUM UPSTREAM STRAIGHT LENGTHS REQUIRED

Fittings before straoght run	Piping Layout	Diameter Ratio (ß)												
		0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.8
Single 90° bend or Tee	A ORIFICE	10	10	10	12	14	14	14	16	18	22	28	36	46
Two or more 90° bends in the same place		14	14	16	16	18	18	20	22	26	32	36	42	50
Two or more 90° bends in the Different planes		34	34	34	36	36	38	40	44	48	54	62	70	80
Reducers or Expanders		16	16	16	16	16	18	20	20	22	24	26	28	30
Globe valve fully open		18	18	18	18	20	20	22	24	26	28	32	36	44
Gate valve fully open		12	12	12	12	12	12	12	14	14	16	20	24	30
MINIMUM DOWN STREAM STRAIGHT LENGTHS REQUIRED.		4	4	5	5	6	6	6	6	7	7	7	8	8

VALUES OF THE STRAIGHT LENGTH ARE IN NO OF 'D'
ß = d/ D d = ORIFICE DIAMETER D = INTERNAL DIAMETER OF PIPE

NOTE :
'A' = UPSTREAM STRAIGHT LENGTH 'B' = DOWNSTREAM STRAIGHT LENGTH

Data required for sizing :

- **Name of fluid**
- **Sp. Gr. of fluid at Operating temperature.**
- **Viscosity of fluid at Operating temperature.**
- **Temperature.**
- **Pressure.**
- **Measuring range**
- **Material of construction desired.**

We reserve the right to modify the Design & Specifications without notice

EUREKA INDUSTRIAL EQUIPMENTS PVT. LTD.

CAT CODE CC-04 R 10-2K

C.E./THERMAL DESIGN, PSEB, PATIALA

VENDOR DOCUMENTS REVIEW STATUS

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AD/MD-I	DD/MD-I	DIR/MECH

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Reviewed by Veena Date 09.05.06

OWNER:	**PUNJAB STATE ELECTRICITY BOARD PATIALA**
PROJECT:	**2 X 250MW GHTP LEHRA MOHABBAT THERMAL POWER PROJECT STAGE – II, UNITS 3 & 4**
OWNER'S CONSULTANT:	**TCE CONSULTING ENGINEERS LIMITED BANGALORE**
CONTRACTOR:	**BHARAT HEAVY ELECTRICALS LTD. POWER SECTOR PROJECT ENGINEERING MANAGEMENT- NEW DELHI**
ENGINEERING SUB CONTRACTOR:-	**FICHTNER CONSULTING ENGINEERS(INDIA) PVT. LTD. CHENNAI.**
VENDOR	**BABUBHAI NAROTTAMDAS & CO. 'BANACO HOUSE' P-1, CAMA INDUSTRIAL ESTATE, WALBHAT ROAD, GOREGAON (EAST), MUMBAI - 400063**

Prepared by	Checked by	Approved by	TITLE: -
PBP	VKM	DRK	LEVEL GAUGE

BHEL DOC NO. –	DOCUMENT NO. –	REV. –
PE-DC-226-174-A060	BNC/A/1115/DS/40-08 (SHEET 1 OF 3)	R0

2 MAY 2006

3472A·619·B106·33 R0

RECORD OF REVISIONS

Rev. No.	Date	Revision Details	Revised by	Approved by
R0	05/04/06	FOR APPROVAL		

TECHNICAL DATA SHEET

BANACO
BABUBHAI NAROTAMDAS & CO.
BANACO House, P-1 Cama Ind Estate,
Walbhat Road, Goregaon (E), Mumbai - 400 063
Phone: 2685 1386, 5699 7530 Fax: 022-2685 2182

DOC NO	:	BNC/A/1115/DS/40-08
REV NO	:	R0
DATE	:	5/4/2006
DESCRIPTION	:	**Level Gauge for caustic Tank** Leak absorption system
SHEET NO.	:	3 of 3

BHEL DOC NO :PE-DC-226-174-A060

P&I DIAGRAM NO. : BNC/4475

1.0	Make	: Levcon
2.0	Type	: Tubular type
3.0	Service	: For Caustic tank CW & RW Leak chlorine absorption system
4.0	Fluid	: 20% NAOH Solution
5.0	Quantity	: 1 No
6.0	Tag Nos.	: LG-3
7.0	Location	: Side mounted on caustic tank
8.0	Mounting Arrangement	: Flange mounted
9.0	Operating pressure	: Atm pressure
10.0	Material of construction	
a	Vent plug 1/2" NPT	: SS 304
b	Protector	: C Frame with epoxy Painted MS
c	Glass tube	: 16 ODToughened Borosilicate glass
d	Drain valve 1/2" NPT Needle valve	: SS 304
e	Scale	: Aluminium
f	Process connection 25 NB ASA 150 # RF	: SS 304
11.0	Max. Hydrotest pressure/Temp.	: 10 Kg/cm2 / 200 Deg C
12.0	CTC	: 2350 mm
13.0	Visibility	: 2200 mm
14.0	Reference	: Catalogue

Levcon Tubular Level Gauge

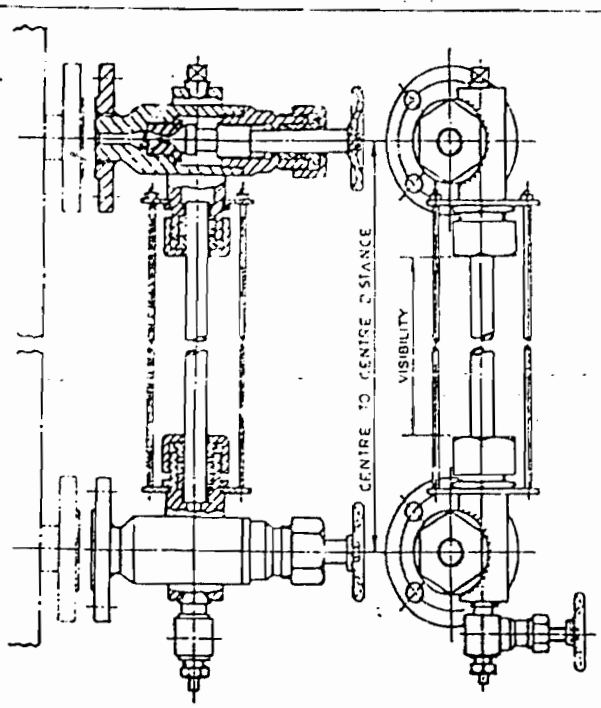


Fig.-1 Tubular Level Gauge (Pr. Class : 10/13 Kg/cm²)
Handwheel Operated, Off-set type, Flanged ends, Screwed Bonnet, Gr. As. Packing, Safety Ball, Needle type Valve for Drain, 4-Guard Rod Protector.

LEVCON Tubular type Level Gauges are used for direct level indication in Tanks and Vessels under Pressure and Temperature. A top and a bottom fitting can be fixed on suitable nozzles or bosses at top and bottom of a Tank with a Glass Tube fitted between them. The liquid level in Glass Tube indicates the level of liquid in Tank.

The top and bottom Valve fittings can be provided with Isolating Valves or Cocks. Isolating Valves (normally Globe type, Handwheel operated. Can also be Weight Lever operated or Push Button operated) can be Off-set type (see Fig. 1) or Straight type. Off–set type (Left Hand or Right Hand type. Left Hand type has Glass Tube on left when seen from front) facilitates fitting of Glass Tube after introducing through Vent Hole opening and cleaning of Glass Tube. 16 mm (5/8") OD Glass Tube can pass through 1/2" BSP/NPT Vent Hole opening. In case of Straight type, as Glass Tube is to be fitted by holding it at an angle, inserting top end into top fitting and then lowering to bottom fitting, the minimum Centre to Centre Distance is about 600 mm. In case of top and bottom fittings having Sleeve Packed Cocks (Straight type only) the Glass Tube can be introduced through Vent Hole.

Top fitting can have Vent Valve (Needle type Valve or Sleeve Packed Cock) instead of Plug (normally 1/2" NPT/BSP). Similarly bottom fitting can have Drain Valve. The end connections can be Flanged (normally 20/25 NB - Flanged to BS/IS/ANSI/DIN Standard) or Socket Weld type (3000 psi rated - normally 20/25 NB) or Screwed type through Union (20/25 NB BSP/NPT-Male; can be Female also).

The material of construction can be Carbon Steel, Gunmetal, Stainless Steel (SS-304/316), Cast Iron, PVC, Polypropylene, etc. Maximum Hydraulic Test Pressure is 3 Kg/cm² in case of PVC/Polypropylene material of construction. The fittings can be Cast (Gunmetal/Cast Iron are normally cast), Fabricated (Carbon Steel, SS-304/316). The Valves have Screwed Bonnets (Bolted Bonnets in case of Forged type). Valve Packings can be Graphited Asbestos, Teflon 'V' Ring or Teflon Rope and Glass Tube Packing can be Graphited Asbestos, Rubber Cone, Teflon 'V' Ring or Teflon Rope (see Fig. 2 & 3).

Top and bottom fittings are provided with Safety Ball Sealing arrangements to prevent gushing out of liquid and gas under pressue in case of Glass Tube breakage (see Fig. 2 & 3). Globe type Valve Spindles are provided with End Pins to disengage Ball if gets stuck in Closed position.

For Glass Tube protection against mechanical damage, Twin Mild Steel (Epoxy painted) Protector, Metal Tube Protector, 4 - Guard Rod Protector (with or without Wire Mesh wrapping) or 3 - Glass Protector can be provided.

Tubular Level Gauges are normally not recommended for Pressure and Temperature higher than 15 Kg/cm² and 200°C.

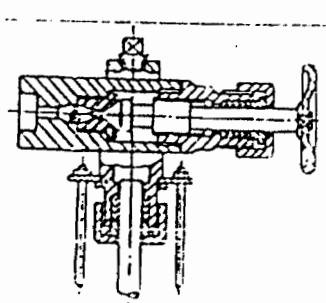


Fig.-2 Top Fitting
Handwheel Operated, Off-set type, SW end, Screwed Bonnet, Teflon 'V' Ring Packing, Safety Ball, Deep Stuffing Box, Vent with Plug, 4-Guard Rod Protector.

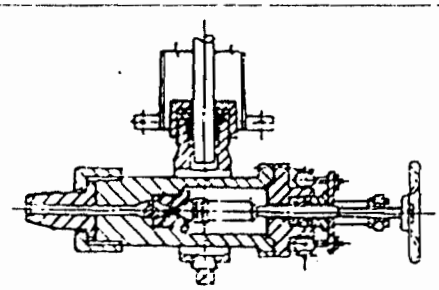


Fig.-3 Bottom Fitting
Handwheel Operated, Off-set type, Screwed (NPT) end through Union, Bolted Bonnet, Rubber Cone Packing for Glass Tube, Safety Ball, Drain with Plug, Twin MS Protector

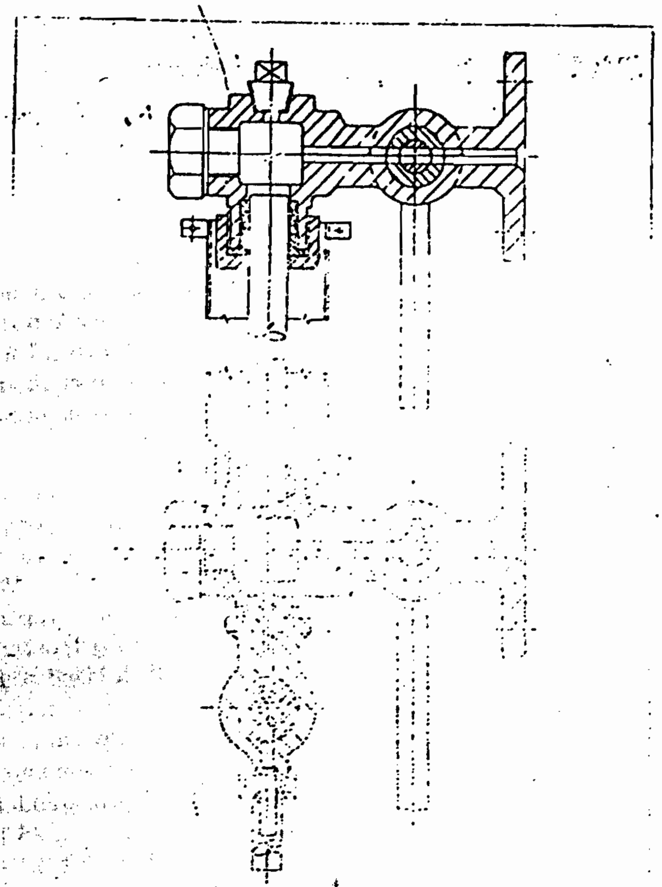


Fig.-4 Tubular Level Gauge (Sleeve Packed Cock type)
Flanged ends, Sleeve Packed Cock for Drain, Twin MS Protector.

SALIENT FEATURES

- 16/19 mm OD (2/3 mm Wall Thickness) Borosilicate Glass Tube as per BS : 3463.
- Visibility is normally 150 mm less than Centre to Centre Distance in case of Straight type Valves or [illegible] material of [illegible] visibility is about 130 [illegible] Centre Distance.

[illegible]

- [illegible]
- [illegible]
- [illegible] Valves [illegible]
- [illegible]
- Intermediate Support (Straight or Off-set) in case of Centre to Centre Distance more than 1400 mm.

MODEL NUMBERS OF TUBULAR LEVEL GAUGES

TG [ ] [ ] [ ] — [ ] [ ] [ ] [ ] S

Glass Tube OD	Pressure Class	Type of Protector	Types of Valves & Combinations	Top Valve Design / Bottom Valve Design	Material of Fittings	Special Features
1. 16 mm 2. 19 mm 3. Other	1. Nominal Pressure 4. 10/13 Kg/cm² 5. Above 10/13 Kg/cm²	0. No Protector 1. Twin MS 2. Three Glass 3. 4-Brass Guard Rod 4. MS Guard Rod 5. MS Tube 6. Brass Tube 9. Other	1. Off-set type at Top and Bottom 4. Straight type at Top and Bottom	0. Without Valves 1. Globe type, Handwheel Operated 2. Globe type, Wt. Lever Operated 3. Globe type, Push Button Operated 6. Sleeve Packed Cocks 9. Any other type	1. Gunmetal 4. SS-304 6. SS-316 7. Cast Iron 8. Carbon Steel 9. Others (including PVC/ Polypropylene)	(Spherical Union, Scale, Heating arrangements, Intermediate Support, IBR Certificate, etc.)

Since improvements are made from time to time Specifications are liable to change without notice

LEVCON INSTRUMENTS PRIVATE LIMITED

Rajkamal, (6th Floor), 13 Camac Street, Calcutta : 700 017
Telephone : 40-3027, 40-3077 Telex : 021-4226 LEV IN Cable : NEWBORN, CALCUTTA

BOMBAY
301 Protoprima Chambers
1, Suren Road, Andheri East
Bombay : 400 093
Telephone : (022) 6363015, Gram : CONLEV, BOMBAY
Telex : 011-79333 LEV IN

HYDERABAD
D 11, IDA, Patancheru
Dist. Medak
Pin : 502 319
Andhra Pradesh,
Telephone : (08453) 3173, Gram : LEVCON

Pub. TG/1 (01.06.92)

Designed by S. Bose, 112/5 Selimpur Road, Calcutta : 700 031

L DESIGN, PSEB, PATIALA

IMENTS REVIEW STATUS

al distribution. Action-6

2. Approved

d except as noted. Forward final drgs.
for manufacture/construction parallely)
ved except as noted rectification.
ubmission is required.
ot approved. See accompanying letter.
For information and record only.
efer Memo No. MD.....Date.....

Approval of the Supplier's drawings by the purchaser does not relieve the Supplier or any part of supplier's obligation to meet all the requirements of the specification. Purchase order of the responsibility for the correctness of the supplier's drawings or documents.

CHECKED	RECOMMENDED	APPROVED
AD/MD-I	DD/MD-I	DIR/MECH

TCE CONSULTING ENGINEERS LTD
VENDOR DOCUMENT REVIEW STATUS

- A. Drawing approved as submitted proceed with fabrication/construction.
- B. Drawing approved subject to comments noted proceed with fabrication/Construction considering our comments.
- C. Our comments are noted on this marked up print.
- D. Our comments are noted in memo attached to the forwarding transmittal letter No. TCE 3472A-IC-VDT/206 Dated 09.05.06
- E. Correct original of this drawing to reflect our comments and resubmit for approval.
- F. Correct original of this drawing to reflect our comments and resubmit for records.
- G. Drawings of this category are for information only and not for approval. Information furnished on the drawing is noted.
- H. Drawing reviewed against our previous comments and other revisions highlighted and identified by the vendor.
- I. Drawing returned without review.

Approval conveyed herein neither relieves Vendor / Contractor of his contractual obligations and his responsibilities for correctness of dimensions, materials of construction, weights, guarantees, design details assembly fits, system performance requirements and conformity of supplies with Indian statutory Laws as may be applicable, nor does it limit the Purchaser's rights under the contract.

Reviewed by ..... Date 09.05.06

OWNER:	**PUNJAB STATE ELECTRICITY BOARD PATIALA**
PROJECT:	**2 X 250MW GHTP LEHRA MOHABBAT THERMAL POWER PROJECT STAGE - II, UNITS 3 & 4**
OWNER'S CONSULTANT:	**TCE CONSULTING ENGINEERS LIMITED BANGALORE**
CONTRACTOR:	**BHARAT HEAVY ELECTRICALS LTD. POWER SECTOR PROJECT ENGINEERING MANAGEMENT- NEW DELHI**
ENGINEERING SUB CONTRACTOR:-	**FICHTNER CONSULTING ENGINEERS(INDIA) PVT. LTD. CHENNAI.**
VENDOR	**BABUBHAI NAROTTAMDAS & CO. 'BANACO HOUSE' P-1, CAMA INDUSTRIAL ESTATE, WALBHAT ROAD, GOREGAON (EAST), MUMBAI - 400063**

Prepared by	Checked by	Approved by	TITLE: -
PBP	VKM	DRK	MAGNETIC FLOAT OPERATED LEVEL SWITCH

BHEL DOC NO. – PE-DC-226-174-A061	**DOCUMENT NO. – BNC/A/1115/DS/40-09 (SHEET 1 OF 4)**	**REV. – R0**

E 2 MAY 2006

3472A·619·B106·32 R0

RECORD OF REVISIONS

Rev. No.	Date	Revision Details	Revised by	Approved by
R0	05/04/06	FOR APPROVAL		

TECHNICAL DATA SHEET

BANACO
BABUBHAI NAROTAMDAS & CO.
BANACO House, P-1 Cama Ind Estate,
Walbhat Road, Goregaon (E), Mumbai - 400 063
Phone: 685 1386, 699 7530 Fax: 022-685 2182

DOC NO	: BNC/A/1115/DS/40-09
REV NO	: R0
DATE	: 5/4/2006
DESCRIPTION	: MAGNETIC FLOAT OPERATED LEVEL SWITCH
SHEET NO	: 3 OF 4

BHEL DOC NO :PE-DC-226-174-A061

P&I DIAGRAM NO. : BNC/4475

1.0	Make	: Levcon
2.0	Model	: LS 31442-62
3.0	Type	: Magnetic Float opearated type
4.0	Service	: For Caustic Tank CW Leak chlorine absorption system
5.0	Tag No.	: LS- 3 & LS-4
6.0	Mounting	: Internal Caustic Tank side Mounted
7.0	Float & Float assembly	
	Body (Non-wetted Parts)	: SS304
	Float	: SS316
	Float assembly	: SS316
	Flange	: SS304
	Flange connection size	: 80 NB ANSI 150# RF Drilled to B 16.5
	Extension Rod	: SS 304, 100mm
8.0	Switch Housing Switch Housing Cover	: SS 304/Aluminium
	Enclosure Weather proof	: WP- IP66
	Electrical Cable entry	: 1/2" NPT(F) One
9.0	Switch Type of Switch	: Microswitch
	No of Contacts	2 Nos SPDT
	Switch contact rating	: 5A,240VAC 1Ph, 50 Hz/0.25 A 220VDC

TECHNICAL DATA SHEET

BANACO
BABUBHAI NAROTAMDAS & CO.
BANACO House, P-1 Cama Ind Estate,
Walbhat Road, Goregaon (E), Mumbai - 400 063
Phone: 685 1386, 699 7530 Fax: 022-685 2182

DOC NO	: BNC/A/1115/DS/40-09
REV NO	: R0
DATE	: 5/4/2006
DESCRIPTION	: MAGNETIC FLOAT OPERATED LEVEL SWITCH
SHEET NO.	: 4 of 4

BHEL DOC NO :PE-DC-226-174-A061

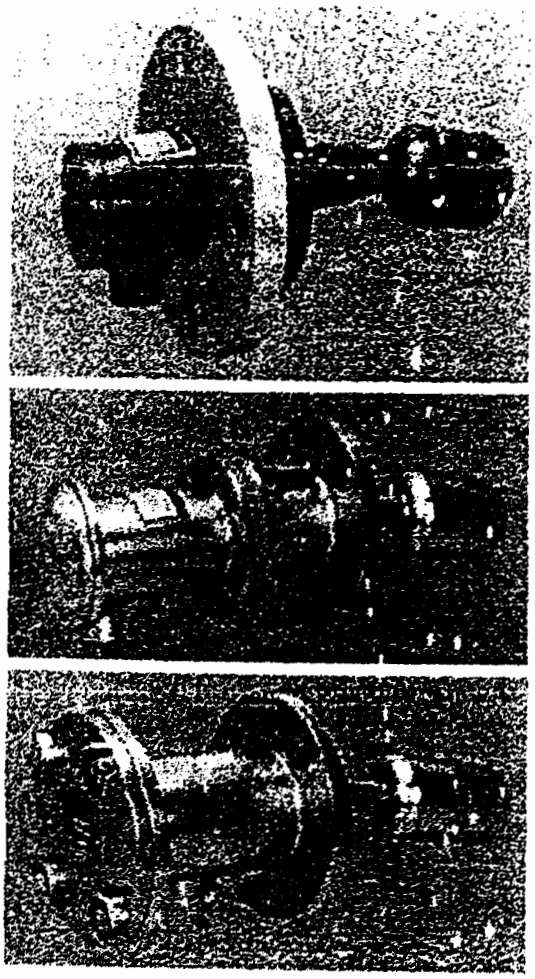
P&I DIAGRAM NO. : BNC/4385

10.0	Max. working Pressure	: 10 Kg/Sq.cm (g)
11.0	Hydraulic test Pressure	: 20 Kg/Sq.cm (g)
12.0	Max. Working Temperature	: 50 Deg C
13.0	Differential	: 30mm +/-2mm Fixed
14.0	Accuracy	: +/- 2mm
15.0	Media	: 20%Caustic
16.0	Specific Gravity	: 1.226
17.0	Caustic Tank Elevation	
17.1	Process normal level	: 2150mm
17.2	Process Pressure	: Atmospheric
17.3	Nozzle Elevation for high alarm level	: 2400mm
17.4	Nozzle Elevation for low alarm level	: 300mm
18.0	Quantity	: 2 Nos (1 No for High alarm & 1 No for Low alarm)
19.0	Testing	: As per approved QAP
20.0	Catalogue	: Attached

Levcon INSTRUMENTS PRIVATE LIMITED

Float Operated Magnetic Level Switches

LS Series Magnetic Level Switches are specially suitable for high and low level signalisation or automatic level control (by starting & stopping pumps or opening & closing of valves) in pressurised or non-pressurised vessels. Horizontal mounting type directly on vessel or on External Chamber.



Features :

- Magnetic Transmission: Switch entirely glandless. Switch housing non-rotatable (rotatability not desired in case of horizontal mounting).
- Suitable for horizontal mounting.
- Adjustable Differential Attachment for higher differential.
- Float with extension Rod for Longer nozzles.
- Level switch with extended Tail-Piece & Counterbalance Weight for high pressure applications.
- Fulcrum Guard with Neoprene Bellows in case of liquids having suspended matters (max temp. 70°C).
- External Chamber for installation of Level Switch outside main vessel with 1" NPT(F) or 1"SW (or flanged) vessel connections at top & bottom or at sides (thro' bent pipes). Chamber is normally 6"NB (can be 8"NB – special application) – fabricated.
- Miniature Model complete with 2M Cable.
- Snap acting/Air Break type contacts or Microswitches.
- IBR/ LLOYDS Certification (if required).
- CMRI Certification CCE/DGFASLI approval, BIS licence for Flame-proof Level Switches under Gas Gr. IIA, IIB (IS2148:1981).

Applications :

Level Alarms & Controls for Storage Tanks, Steam Drums etc. in Power Plants, Petrochemical Plants & Refineries, Chemical Plants, Paper Mills, Sugar Mills etc.

Principle of Operation :

With the rise of liquid level, the float moves up thereby lowering the tailpiece (and Vice versa). The tailpiece magnet, by principle of repulsion pushes a magnet inside Level Switch Body. The Magnet makes or breaks contacts (Air-break type) or operates one or two Microswitches. Switches operated by snap action due to principle of repulsion.

Specifications :

Materials of Construction	Body	:	SS 304/ SS 316/ Gun Metal/ Ebonite/ Teflon/ PVC.
	Float	:	SS 304/ SS 316/ Ebonite/ Teflon, ECTFE/ FEP Coated If required.
	Chamber	:	Carbon Steel / SS 304/ SS 316 / ECTFE/ FEP Coated/ Lined , Rubber lined if required.
	Cover	:	Aluminium / Stainless Steel / Ebonite.

Enclosure Class : Weatherproof to IP66 or weatherproof & flameproof (to Gas Groups I, IIA, IIB or IIC as per IS 2148 : 1981).

Vessel Connection : Levcon Standard Flanges (92 mm Sq.or 120.5 mm dia round X 11 mm thick having 4 nos. 14 mm dia bolt holes at 92 mm PCD in case of pressure upto 10kg/cm², 140 mm dia X 22.7 mm thick having 4 nos 17.5 mm dia bolt holes at 105 mm PCD in case of Ebonite/Teflon/PVC type. 82.5 mm Sq. X 9.5 mm thick having 4 nos 9.5 mm dia bolt holes at 82.5 mm PCD in case of Miniature type) or as per IS /BS /ANSI /DIN Standard (min. 65 NB).

Flanged / Screwed/ Sw in case of External Chambers.

Pressure Rating : 110 Kg/Cm² max (75 Kg/Cm² max in case of flameproof models). Please refer to us in case of higher pressure. Max. 0.4 Kg/Cm² in case of Ebonite, 0.6 Kg/Cm² in case of Teflon / PVC and 5 Kg/Cm² in case of Miniature Model.

Temperature Rating : 500°C max. or higher and - 200°C min. with Intermediate Chamber (max. 210°C for standard models).Max.55°C in case of Ebonite, 80°C in case of Teflon / PVC & 150°C in case of Miniature Model.

Specific Gravity : 0.75 - 1.2. Special Floats for other Specific Gravities and Interface Applications.

Differential : 12 mm ± 2 mm (higher where extension rod provided) 17 ± 2 mm When Fulcrum Guard with Neoprene Bellows provided.

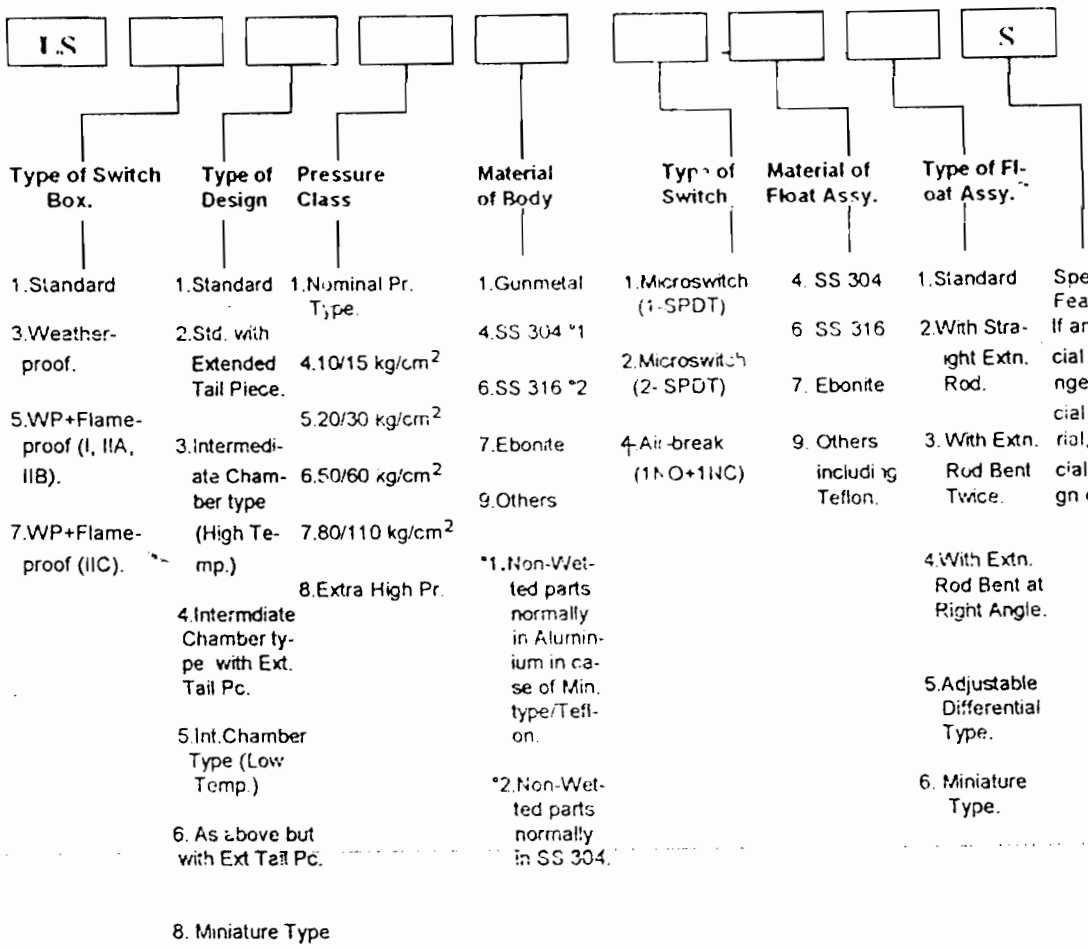
Contact Type : Air Break Type (1NO+1NC) or Microswitch (1 SPDT or 2 SPDT)(Standard or Hermetically sealed Microswitch having Silver/ Gold contacts).

Contact Rating	Air Break Type	:	2A at 250 V AC / 2A at 24 V DC.
	Micro Switch (standard type)	:	5A at 230V AC/4A at 24V DC (please refer to us in case of special or Hermetically sealed microswitches).

Cable Entry : ½", ¾" NPT as standard , other types when required.

Vent/ Drain Connection : As required (where External Chamber provided).

MODEL NUMBER OF FLOAT OPERATED MAGNETIC LEVEL SWITCHES



N.B :1. Pressure Class 4,5,6,7 are basically 150/300/600/900 ANSI rated & hence max.pressure may be higher than indicated.

2. All Combinations not possible . Please contact us in case of doubt.

Since improvements are made form from time to time , the specifications are liable to change without notice.

Head Office Address : "RajKamal" Bldg, 6th Floor, 13, Camac Street, Kolkata – 700017, Tel : (033)2283-2764/66, (033)2280-7180 Fax : (033)2283-2719/2280-9645. E-mail : levconh@vsnl.net. levconm@vsnl.net.

Mumbai Branch Address : 301, Protprima Chambers, 1 Suren Road,Andheri East, Mumbai-400093, Tel :(022)2683-2127/ 2683-3015, Fax : (022)2683-3015. E-mail : levconm@vsnl.net, www.levcongroup.com.

LI/LS/01 (Dt. 17.06.2003).

Furnish list of installation of Chlorine Residual analyser in India supplied by Alldos, Germany in the last 3 years.

THERMAL DESIGN, PSEB, PATIALA
VENDOR DOCUMENTS REVIEW STATUS

1. Copies of final distribution.
2. Approved.
3. Approved except as noted. Forward final drgs. (Proceed for manufacture/construction parallely)
4. Approved except as noted rectification. Resubmission is required.
5. Not approved. See accompanying letter.
6. For information and record only.

Refer Memo No. MD........................Date..............

Approval of the Supplier's drawings by the purchaser does not relieve the Supplier or any part of supplier's obligation to meet all the requirements of the specification. Purchase order or of the responsibility for the correctness of the supplier's drawings or documents.

CHECKED	RECOMMENDED	APPROVED
AD/MD-I 16/5	DD/MD-I 16/5	DIR/MTC

TCE CONSULTING ENGINEERS LTD
VENDOR DOCUMENT REVIEW STATUS

- [x] A. Drawing approved as submitted...
- [ ] B. Drawing approved subject to ... noted ...
- [ ] C. Our comments are not as ... supplier
- [ ] D. Our comments ... forwarding ... Dated 09.05.06 TCE 3472A-IC-VDT/206
- [ ] E. Correct ... to reflect our comments ...
- [ ] F. Correct ... to reflect our comments ...
- [ ] G. Drawings ... information only ...
- [ ] H. Drawings reviewed ... our previous comments ... identified by the vendor
- [ ] I. Drawing ... review.

Approval ... Vendor / Contractor of ... and his responsibility ... of construction ... assembly ... conformity ... be applicable, nor does it limit the Purchaser's rights under the contract.

Reviewed by ________ Date 09.05.06

OWNER:	PUNJAB STATE ELECTRICITY BOARD PATIALA
PROJECT:	2 X 250MW GHTP LEHRA MOHABBAT THERMAL POWER PROJECT STAGE – II, UNITS 3 & 4
TCE OWNER'S CONSULTANT:	TCE CONSULTING ENGINEERS LIMITED BANGALORE
BHEL CONTRACTOR:	BHARAT HEAVY ELECTRICALS LTD. POWER SECTOR PROJECT ENGINEERING MANAGEMENT- NEW DELHI ENGINEERING SUB CONTRACTOR:- FICHTNER CONSULTING ENGINEERS(INDIA) PVT. LTD. CHENNAI.
BANACO VENDOR	BABUBHAI NAROTTAMDAS & CO. 'BANACO HOUSE' P-1, CAMA INDUSTRIAL ESTATE, WALBHAT ROAD, GOREGAON (EAST), MUMBAI - 400063

Prepared by	Checked by	Approved by	TITLE: -
PBP	VKM	DRK	CHLORINE RESIDUAL ANALYSER FOR CW SYSTEM (PORTABLE TYPE)

BHEL DOC NO. –	DOCUMENT NO. –	REV. –
PE-DC-226-174-A063	BNC/A/1115/DS/40-11 (SHEET 1 OF 3)	R0

12 MAY 2006

3472A·619·B106·31 R0

RECORD OF REVISIONS

Rev. No.	Date	Revision Details	Revised by	Approved by
R0	05/04/06	FOR APPROVAL		

TECHNICAL DATA SHEET

BANACO
BABUBHAI NAROTAMDAS & CO.
BANACO House, P-1 Cama Ind Estate,
Walbhat Road, Goregaon (E), Mumbai - 400 063
Phone: 2685 1386, 5699 7530 Fax: 022-2685 2182

DOC NO	:	BNC/A/1115/DS/40-11
REV NO	:	R0
DATE	:	5/4/2006
DESCRIPTION	:	**CHLORINE RESIDUAL ANALYSER FOR CW SYSTEM (PORTABLE TYPE)**
SHEET NO.	:	3 OF 3

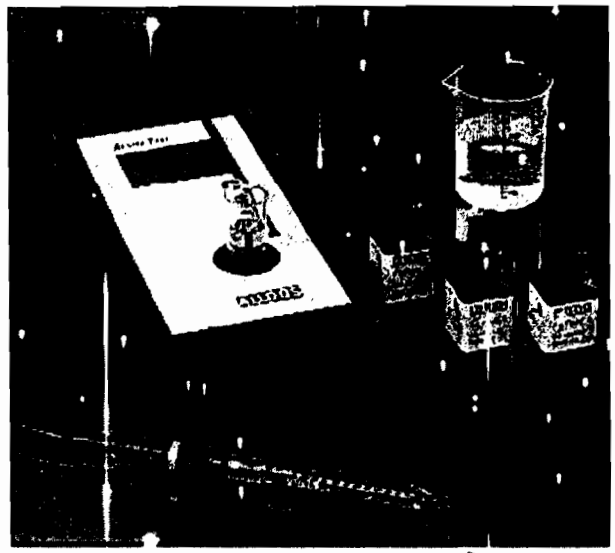
BHEL DOC NO :PE-DC-226-174-A063

P&I DIAGRAM NO. : BNC/4472

1.0	**Make**	:	Alldos Germany
2.0	**Type**	:	Photometrical measuring
3.0	**Qty.**	:	1 No for CW Chlorination system
4.0	**Model**	:	Allcon Test 310 -105 N Version
5.0	**Electronics**	:	Microprocessor controlled energy saving CMOS
6.0	**Display**	:	4 line,16 character LCD
7.0	**Measuring Range**	:	0.03 - 5.00 PPM
8.0	**Memory capacity**	:	about 17 Measuring results
9.0	**Enclosure**	:	52 x 121 x 252mm ABS IP65
10.0	**Admissible Ambient Temp.**	:	5 Deg C to 45 Deg C
11.0	**Admissible Storage Temp. for reagents**	:	15 Deg C to 25 Deg C
12.0	**Operation**	:	Membrane Keyboard with 4 Keys
13.0	**Power supply**	:	9V Alkaline monoblock battery
14.00	**Weight**	:	600 Gms Approx
15.0	**Each Allcon test 310 N version (Portable Type measuring Kit) composed of :-** Plastic case storage case including Vials & Measuring tools, cleaning brush. Reagent Sets & Buffer Solution 549-201 for 350 analyses		
16.0	**Reference document**	:	Catalogue for Allcon Test 310

Allcon® Test 310

A convenient, quick and precise way to check your water



You don't need much experience

Thanks to the high operation convenience combined with simple, multilingual plain-text operator prompting and a large display you will be capable to test your water quickly and reliably even without any special experience.

If you have some experience in testing waters, however, you can simply quit the operator prompting by chosing the expert mode or the profi-mode.

All measured values are well reproducible

We don't leave anything to chance: precision means to us, that your measured values are highly accurate and well reproducible. Check your sample water again: you will always have the same result with high accuracy. In addition, the modern and handy analyzing unit provides long-term stable measured values.

Keep from being disturbed...

Does your water sample show some turbidity? Is external light influence impossible to avoid during measuring? Maybe the light source of your Photometer is a little bit aged already?

No problem, as due to our patented four-beam measuring principle the compact photometer Allcon Test simply compensates those disturbing influences. The combined effect of ultra-modern optics and high-performance microprocessor electronics provides measuring results within a few minutes or even seconds.

Being mobile and flexible with Allcon Test

The large the variety of water contents to be tested, the extensive the application range of the photometer. Wether it is used as a unit for laboratory analysis or as a mobile compact measuring unit: Allcon Test is predetined for the adjustment of stationary measuring systems, the monitoring, routine checking and measurement recording of

- swimming pool water,
- drinking water,
- ground and surface water,
- industrial process water and service water as well as
- slightly polluted waste water.

Highlights overview

- **for operators without experience:** simple multilingual plain-text operator prompting
- **for trained persons:** operator prompting can be switched off by expert mode or profi-mode
- mobility by handiness
- automatic zero point adjustment by pressing a key, error detection, real time clock
- up to 17 parameters can be measured
- additional electro-chemical pH measurement with temperature compensation of the complete pH-range (0-14) and redox potential
- interface RS 232 for printer or PC
- favourable price-performance ratio of the reagents for the analysis.

ALLDOS

www.alldos.de

Allcon® Test 310

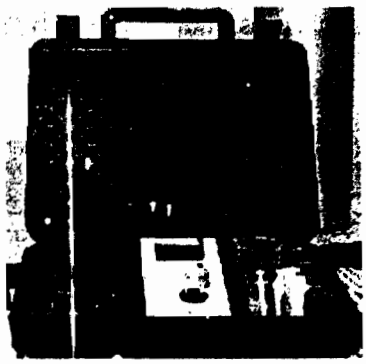
A convenient, quick and precise way
to check your water

Design Variants

For a wide variety of different applications Allcon Test is being delivered in three versions:

- **B version (especially for swimming water):**
  for photometrical determination of aluminium, chlorine, chlorine dioxide, cyanuric acid, iron, ozone and pH.
  Power supply: 9 V monoblock battery assures the memory capacity for approx. 100 measurements
- **N version:**
  for photometrical determination of aluminium, ammonium, chlor, chlorine dioxide, cyanuric acid, iron, fluoride, nitrate, nitrite, ozone and pH.
  Power supply: 9 V monoblock battery assures the memory capacity for approx. 100 measurements
- **S version:**
  for photometrical determination of aluminium, ammonium, chlor, chlorine dioxide, chrome, cyanide, cyanuric acid, iron, fluoride, hydrazine, manganese, nickel, nitrate, nitrite, ozone, pH and phosphate.

  With BNC socket and single-rod pH/NTC- or redox-electrodes for electrochemical measuring of pH value with temperature compensation and redox potential.
  RS 232 interface (socket) for printer or PC.
  Power supply: a set of accumulators with charger is integrated for the increased power consumption of the single-rod electrodes.



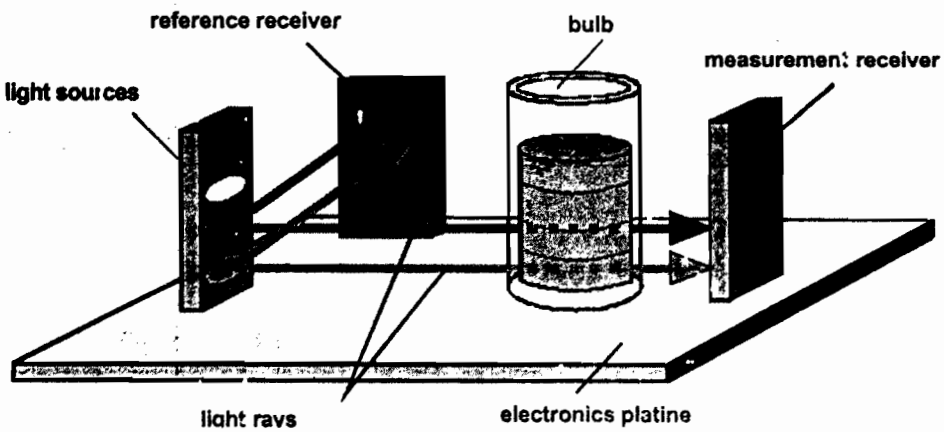
Allcon Test N
in the storage case

Allcon® Test in plastic case including vials and measuring tools

Order No.	Description
310-055	B version with 9 V monoblock battery
310-105	N version with 9 V monoblock battery
310-205	S version with built-in accumulator, including loading adaptor

Opto-electronic four-beam measuring principle

Aluminium	Ammonium	Cyanide	Cyanuric acid	Chlorine	
Chlorine dioxide	Chloride	Chromium	Iron	Fluoride	Hydrazine
Manganese	Nickel	Nitrate	Nitrite	Ozone	Phosphate	pH



Allcon® Test 310

A convenient, quick and precise way to check your water

Technical Data

General technical data	
optics	patented four-beam principle with carrier frequency technology
electronics	microprozessor-controlled, energy-saving CMOS technology
display	large and well-legible LCD, alphanumeric, 4 lines, 10 characters each
operation	membrane-keyboard with 4 keys, plain-text operator prompting in English, German and French
memory capacity	for about 17 measuring results
vials	22 mm Ø
enclosure	52 x 121 x 252 mm, materia.: ABS, IP 65
adm. ambient temp.	+ 5°C to + 45°C
adm. storage temp. of reagents	+ 15°C to + 25°C
weight	about 600 g

Electrical data	
power supply	**Allcon Test B and N:** 9 V Alkaline monoblock battery, plain-text indication for battery exchange **Allcon Test S:** rechargeable accumulator, indication for accumulator charge
interfaces (Allcon Test S)	RS 232, 4800 baud, 8 bit
	BNC socket for single rod pH- and redox-electrodes, socket for temperatur sensor

Function	
autom. switching off	photometrical measuring: after 45 seconds electrochemical measuring: after 80 seconds
further functions	real-time clock, automatic zero point adjustment by key pressure, indication in mg/l or ppm, operator prompting can be switched off by expert mode or profi-mode

Measuring Parameters and Measuring Ranges

Parameters	Measuring range			
photometrical measuring				
aluminium	0,02	-	0,5	mg/l(ppm)
ammonium	0,2	-	3,0	mg/l (ppm)
chlorine (free and combined)	0,03	-	5,0	mg/l (ppm)
chlorine dioxide	0,05	-	10,0	mg/l (ppm)
chloride	1	-	100	mg/l (ppm)
chromium	0,02	-	0,5	mg/l (ppm)
cyanide	0,01	-	0,7	mg/l (ppm)
cyanuric acid	1	-	200	mg/l (ppm)
iron	0,1	-	1,2	mg/l (ppm)
fluoride	0,1	-	2,0	mg/l (ppm)
hydrazine	0,05	-	3,0	mg/l (ppm)
manganese	0,07	-	4,0	mg/l (ppm)
nickel	0,07	-	4,0	mg/l (ppm)
nitrate	0,5	-	30,0	mg/l (ppm)
nitrite	0,02	-	1,0	mg/l (ppm)
ozone	0,03	-	3,0	mg/l (ppm)
pH	6	-	8,5	pH
phosphate	0,07	-	4,5	mg/l (ppm)
electrochemical measuring				
pH	0	-	14	pH
Redox	-1200	-	+1200	mV
temperature	-20	-	+80	°C

Technical data subject to change without notice

Allcon® Test 310

A convenient, quick and precise way to check your water

Reagent Sets and Buffer Solutions

Order no.	Reagent	Number of analyses
	pH	200
	chlorine (free and total) also for chlorine dioxide and ozone	350
	free chlorine	350
	additional reagent 1 *) for chlorine dioxide	150
	nitrate	200
	aluminium	200
	iron	200
	ammonium	250
	hydrazine	200
	manganese	220
	chrome	150
	nickel	250
	nitrite	220
	phosphate	200
	chloride	200
	additional reagent 1 *) for ozone	200
	additional reagent 2 *) for chlorine dioxide	350
	cyanide	200
	fluoride	250
	cyanuric acid	200

*) additional reagents only in presence of chlorine or together with 549-201

Further testing kits

Order no.	Reagent	Number of analyses
Water hardness quick test (can be used without Allcon Test)		
	total hardness	500
	residual hardness	340
Tritrations set for determination of acid capacity (can be used without Allcon Test)		
549-230	titrations set	200

Accessories

Order no.	Description
310-300	storage case for Allcon Test including vials, measuring bowl, cleaning brush, dosing syrings set of standard bulbs
549-100	**chemicals case for N version** including collecting bottle and diluting water, without chemicals
549-110	**chemicals case for S version** including collecting bottle and diluting water, without chemicals
549-105	**chemicals case for N version** fully equipped including all necessary chemicals
549-120	**chemicals case for S version** fully equipped including all necessary chemicals
Electrodes	
312-101	single-rod pH electrode with temperature sensor, pH 0-14, with 1,0 m coaxial cable and BNC connector
313-101	single-rod Redox electrode , +/- 1200 mV, with 1,0 m coaxial cable and BNC connector
Printer	
336-100	printer, accumulator with mains adaptor 230 V, paper width about 57 mm
336-500	printer paper, 5 rolls
Vial sets	
549-010	vial set standard, consisting of 5 standard vials without labelling and 5 covering caps
549-011	vial set special, consisting of 5 vials marked with 1 x "Cl_2-1", 1 x "Cl_2-2", 1 x "NH_4", 1x "Fe", 1 x "PO_4" and 5 covering caps

www.alldos.de

ALLDOS

ALLDOS Eichler GmbH
Reetzstraße 85 • 76327 Pfinztal (Söllingen)
Postfach 1160 • 76318 Pfinztal
Tel. +49 72 40 61 0 / Fax +49 72 40 61 177
E-Mail: alldos@alldos.de

C.E./ THERMAL DESIGN, PSEB, PATIALA

VENDOR DOCUMENTS REVIEW STATUS Action-6

1. Copies of final distribution.
2. ~~Approved.~~ Action-6
3. Approved except as noted. Forward final drgs. (Proceed for manufacture/construction parallely)
4. Approved except as noted rectification. Resubmission is required.
5. Not approved. See accompanying letter.
6. For information and record only.

Refer Memo No. MD.....Date.....

Approval of the Supplier's drawings by the purchaser does not relieve the Supplier or any part of supplier's obligation to meet all the requirements of the specification. Purchase order or of the responsibility for the correctness of the supplier's drawings or documents.

CHECKED	RECOMMENDED	APPROVED
ADM/E	16/5	DIR/MECH

TCE CONSULTING ENGINEERS LTD

VENDOR DOCUMENT REVIEW STATUS

- ☑ A. Drawing approved as submitted: proceed with fabrication/construction.
- ☐ B. Drawing approved subject to comments noted: proceed with fabrication/Construction considering our comments.
- ☐ C. Our comments are noted on this marked up print.
- ☐ D. Our comments are noted in memo attached to the forwarding transmittal letter No. ..... Dated 09.05.06 TCE 3472A-IC-VDT/206
- ☐ E. Correct original of this drawing to reflect our comments and resubmit for approval.
- ☐ F. Correct original of this drawing to reflect our comments and resubmit for records.
- ☐ G. Drawings of the above category are for information only and not for approval. Information furnished on the drawing is noted.
- ☐ H. Drawing reviewed against our previous comments and other revisions highlighted and identified by the Vendor.
- ☐ I. Drawing returned without review.

Approval conveyed herein neither relieves Vendor / Contractor of his contractual obligations and his responsibilities for correct sizes, dimensions, materials of construction, weights, ratings, design details, assembly, fits, systems, performance requirements and conformity of all parts with the applicable statutory laws as may be applicable, nor does it limit the Purchaser's rights under the contract.

Reviewed by Veena Date 09.05.06

OWNER:	PUNJAB STATE ELECTRICITY BOARD PATIALA
PROJECT:	2 X 250MW GHTP LEHRA MOHABBAT THERMAL POWER PROJECT STAGE – II, UNITS 3 & 4
OWNER'S CONSULTANT:	TCE CONSULTING ENGINEERS LIMITED BANGALORE
CONTRACTOR:	BHARAT HEAVY ELECTRICALS LTD. POWER SECTOR PROJECT ENGINEERING MANAGEMENT- NEW DELHI
ENGINEERING SUB CONTRACTOR:-	FICHTNER CONSULTING ENGINEERS(INDIA) PVT. LTD. CHENNAI.
VENDOR	BABUBHAI NAROTTAMDAS & CO. 'BANACO HOUSE' P-1, CAMA INDUSTRIAL ESTATE, WALBHAT ROAD, GOREGAON (EAST), MUMBAI - 400063

Prepared by	Checked by	Approved by	TITLE: -
PBP	VKM	DRK	SOLENOID VALVE

BHEL DOC NO. –	DOCUMENT NO. –	REV. –
PE-DC-226-174-A058	BNC/A/1115/DS/40-06 (SHEET 1 OF 3)	R0

RECEIVED 2 MAY 2006

3472A·619·B106·35 R0

RECORD OF REVISIONS

Rev. No.	Date	Revision Details	Revised by	Approved by
R0	05/04/06	FOR APPROVAL		

TECHNICAL DATA SHEET

BANACO
BABUBHAI NAROTAMDAS & CO.
BANACO House, P-1 Cama Ind Estate,
Walbhat Road, Goregaon (E), Mumbai - 400 063
Phone: 685 1386, 699 7530 Fax: 022-685 2182

DOC NO	: BNC/A/1115/DS/40-06
REV NO	: R0
DATE	: 5/4/2006
DESCRIPTION	: **SOLENOID VALVE**
BHEL DOC NO :PE-DC-226-174-A058	SHEET NO. : 3 of 3

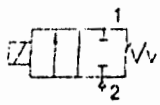
P&I DIAGRAM NO. : BNC/4472

1.0	Make	: Rotex
2.0	Model	: 20121-6-4R-B2+240V AC-15
3.0	Service	: For Evaporator Make up Water CW Chlorination system
4.0	Tag Nos	: V-72 & V-73
5.0	Quantity	: 2 Nos
6.0	Type	: 2/2 Direct acting, Normally Closed, Low pressur
7.0	Fluid	: Water
8.0	Orifice	: NW 6mm
9.0	Flow Factor	: 12 Kv
10.0	Working Pressure	: 0 - 4 Kg/sq. cm
11.0	Connection	: 1/2" NPT (F)
12.0	Body Material	: Brass
13.0	Trim & Spring Material	: SS 316
14.0	Operation	: Direct
15.0	Coil Voltage	: 240V AC
16.0	Coil Insulation	: Class 'H'
17.0	Coil Size	: II
18.0	Coil Type	: Air Cooled -Terminal Box IP-67, 3/4" ET
19.0	Degree of Protection	: IP-67
20.0	Catalogue	: Attached

2/2 DIRECT ACTING LOW PRESSURE SOLENOID VALVE

TYPE	PRESSURE	TYPE	PRESSURE	TYPE	PRESSURE
20120	0-2 bar	20122	0-2 bar	20124	0-0.3 bar
20121	0-6 bar	20123	0-1.5 bar		
20210	0-6 bar				

NC



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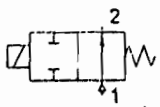



PHOTOGRAPHED WITH FLAMEPROOF SOLENOID.

FEATURES

- Line mounted valve.
- Normally Closed/Normaliy Open operation available.
- Special versions may be developed on request.
- Manual actuator options are not available.
- Suitable for vacuun. up to 10^{-6} Torr.
- Suitable for air, water, gas, liquid oil,diesel,kerosene,LPG, naptha,CNG.LDO,Fuel gas,furnace oil,etc.

CONNECTIONS

TYPE	INLET	OUTLET
20120,20121,20122,20123 20124	2	1
20210	1	2

ORDERING CODE

VALVE CODE

For options available : Refer page E-5 for c; page E-3 for a.

TYPE SUFFIX — a — b — c — d — e

ORIFICE	
5 mm	5
6 mm	6
8 mm	8
10 mm	10
12 mm	12

PORT CONNECTION		
SIZE	BSP	NPT
1/4"	2G	2R
3/8"	3G	3R
1/2"	4G	4R

BODY & INTERNAL

MANUAL OVERRIDE	
Nil	⁂

SEAL	
NBR	⁂
EPDM	S1
VITON	S2
NEOPRENE	S3

SOLENOID CODE

For options available : Refer page E-5.

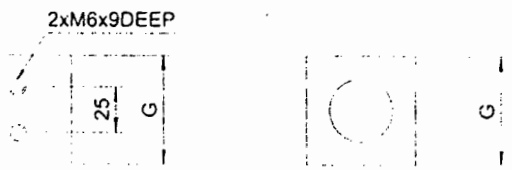
⁂ Need not be specified while ordering

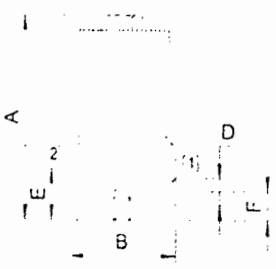
ORDERING EXAMPLE

Standard Version 20122D-8-3G+24V-DC
Special Version 20122F-8-3G-B3-S2+24V-DC-22-H

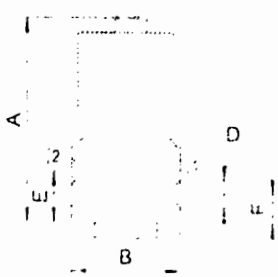
DIMENSIONS

TYPE	ORIFICE	A	B	D	E	F	G
20120	B	83	50	1/4"	10.5	17	40
	C	83	50	1/4"	10.5	17	50
	E	83	44	1/4"	10.5	17	ø48
	D	83	65	3/8" OR 1/2"	10.5	17	50
	F	89	58	3/8" OR 1/2"	10.5	17	ø62
20121	C	102	50	1/4"	10.5	14	50
	G	104	48	1/4"	10.5	18	ø52
20210	D	102	65	3/8" OR 1/2"	14	14	50
	F	108	58	3/8" OR 1/2"	14	14	62
20122	D	102	65	3/8" OR 1/2"	14	14	50
20210	F	108	58	3/8" OR 1/2"	14	14	62
20123	D	102	65	3/8" OR 1/2"	14	14	50
20210	F	108	58	3/8" OR 1/2"	14	14	62
20124	D	102	65	3/8" OR 1/2"	14	14	50
	F	108	58	3/8" OR 1/2"	14	14	62





Construction-I



Construction-II

Note (1) Construction-II for valve type 20210 only.

Specifications are subject to change without notice.

C.E./THERMAL DESIGN, PSEB, PATIALA

VENDOR DOCUMENTS REVIEW STATUS

1. Copies of final distribution.
2. Approved.
3. Approved except as noted. Forward final drgs. (Proceed for manufacture/construction parallely)
4. Approved except as noted rectification. Resubmission is required.
5. Not approved. See accompanying letter.
6. For information and record only.

Refer Memo No. MD.....Date.....

Approval of the Supplier's drawings by the purchaser does not relieve the Supplier or any part of supplier's obligation to meet all the requirements of the specification. Purchase order or of the responsibility for the correctness of the supplier's drawings or documents.

CHECKED	RECOMMENDED	APPROVED
AD/MD-I	DD/MD-I	DIR/MECH

TCE CONSULTING ENGINEERS LTD

VENDOR DOCUMENT REVIEW STATUS

- ☐ A. Drawing approved as submitted: proceed with fabrication/construction.
- ☑ B. Drawing approved subject to comments noted proceed with fabrication/Construction considering our comments.
- ☐ C. Our comments are noted on this marked up print
- ☐ D. Our comments are noted in memo attached to the forwarding transmittal letter/No. TCE 3472A-JC-VDT/2 Dated 09.05.06
- ☐ E. Correct original of this drawing to reflect our comments and resubmit for approval.
- ☑ F. Correct original of this drawing to reflect our comments and resubmit for records.
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- ☐ I. Drawing returned without review.

Approval conveyed herein neither relieves Vendor / Contractor of his contractual obligations and his responsibilities for correctness of dimensions, material of construction, weights, quantities, design data assembly fits, system performance requirements & conformity of supplies with Indian statutory Laws as may be applicable, nor does it limit the Purchaser's rights under the contract.

Reviewed by ..... Date 09.05.06

① Protection shall be IP-55
② 8 Nos SPDT Contacts shall be provided.

OWNER:	**PUNJAB STATE ELECTRICITY BOARD PATIALA**
PROJECT:	**2 X 250MW GHTP LEHRA MOHABBAT THERMAL POWER PROJECT STAGE – II, UNITS 3 & 4**
OWNER'S CONSULTANT:	**TCE CONSULTING ENGINEERS LIMITED BANGALORE**
CONTRACTOR:	**BHARAT HEAVY ELECTRICALS LTD. POWER SECTOR PROJECT ENGINEERING MANAGEMENT- NEW DELHI**
ENGINEERING SUB CONTRACTOR:-	**FICHTNER CONSULTING ENGINEERS(INDIA) PVT. LTD. CHENNAI.**
VENDOR	**BABUBHAI NAROTTAMDAS & CO. 'BANACO HOUSE' P-1, CAMA INDUSTRIAL ESTATE, WALBHAT ROAD, GOREGAON (EAST), MUMBAI - 400063**

Prepared by	Checked by	Approved by	TITLE: -
PBP	VKM	DRK	DIFFERENTIAL PRESSURE GAUGE WITH ELECTRIC CONTACT

BHEL DOC NO. –	DOCUMENT NO. –	REV. –
PE-DC-226-174-A057	BNC/A/1115/DS/40-05 (SHEET 1 OF 3)	R0

2 MAY 2006

3472A·614·B106·36 R0

RECORD OF REVISIONS

Rev. No.	Date	Revision Details	Revised by	Approved by
R0	05/04/06	FOR APPROVAL		

TECHNICAL DATA SHEET

BANACO
BABUBHAI NAROTAMDAS & CO.
BANACO House, P-1 Cama Ind Estate,
Walbhat Road, Goregaon (E), Mumbai - 400 063
Phone: 26851386,56997530 Fax: 022-2685 2182

DOC NO	: BNC/A/1115/DS/40-05
REV NO	: R0
DATE	: 5/4/2006
DESCRIPTION	: DIFFERENTIAL PRESSURE GAUGE WITH ELECTRIC CONTACT
SHEET NO.	: 3 of 3

BHEL DOC NO :PE-DC-226-174-A057

P&I DIAGRAM NO. : BNC/4472 & 4473

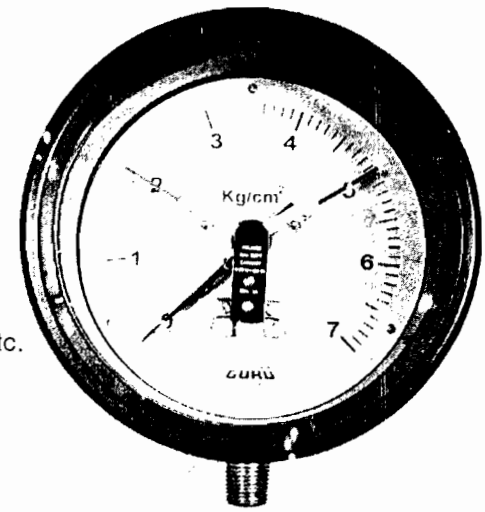
1.0	Make/Product Code	: HGuruSouth/06DDSSSA2 MEC-0C
2.0	Type	: Single Diaphragm type
3.0	Service	: For Chlorine gas & Water Strainer CW & RW Chlorination system
4.0	Mounting	: Direct Bottom Entry
5.0	Dial Size	: DIA:150 MM
6.0	Range	: 0- 6 Kg/Sq.cm
7.0	Accuracy	: +/- 1.5% of F.S.D
8.0	Ambient Temperature	: -5°c to 40°c
9.0	Process Temperature	: 100°c
10.0	Static Pressure	: Upto 100 Kg/Sq.cm
11.0	Protection	: IP : 55 IP65
12.0	Gauge Connection	: 1/2" NPT (M) x 2 Nos.
13.0	Contact type	: Magnetic snap action 1 NO + 1NC
14.0	Switch contact rating	: 1A,240VAC 1Ph, 50 Hz
15.0	Material of Construction	
	Case & Bezel	: Aluminium alloy
	Diaphragm	: SS316
	Movement	: AISI 304 SS with internal limits stops for Min & Max Pressure
	Chamber	: AISI 304 SS
	Dial	: Aluminium black graduation on white back ground
	Pointer	: Aluminium black Coloured micrometer Zero adjustable
	Case Gasket	: Neoprene
	Window	: Glass 4mm Thk
	Over range relief Plug	: Provided
16.0	Tag No.	: DPI-1, DPI-2 for Chlorine gas & DPI-3 for water CW system, DPI-4 FOR Chlorine Gas RW System
17.0	QTY.	: 4 Nos
18.0	Testing	: As per approved QAP
19.0	Catalogue	: Attached

HGuruSouth

Contact Type Pressure Gauges

GURU
SOUTH

Contact Type Pressure Gauges:



Contact type pressure gauges are used in controlling and monitoring of pressure equipment. These gauges incorporate pressure indicators with electric contact systems. The contacts have either one or two set pointers, which traverse over the instrument's dial. The contact is actuated by a pin mounted on the indicating pointer of the instrument. The adjustment of the set pointers is achieved by means of a adjusting arm assembly on the window of the instrument. These contact systems generate ON/OFF electrical signals at certain preset pressure which can be transmitted to buzzers, alarms, control lights, motors, solenoid valves etc.

These are suitable for application in chemical plants, storage tanks, steam generators, fire hydrant systems, pneumatic transmitters etc.

Technical Specifications:

Dial Sizes: 100mm, 150mm
Accuracy (10 ~ 90% of scale): +/- 1% FSD, +/- 1.5% FSD, +/- 2% FSD (Diaphragm & Differential Types)
Standard Ranges: Refer Table CPG-1
Working Pressure: 10 ~ 70% of Scale (Steady Pressure), 10 ~ 50% of Scale (Fluctuating Pressure)
Over Pressure Protection (Short Duration Only): 10% of scale for all ranges and all types
Ambient Temperature: -5 C ~ 40 C
Temperature Error: +/-0.3% FSD for every 10 C increase or decrease from reference temperature of 25 C
Contact Type: Magnetic Snap Action
Electrical Rating:
$V_{...}$ = 350VAC / 240VDC
$I_{...}$ = 1A
Switch Capacity = 30W / 50VA
Contact Options: 1NO, 1NC, 1NO-1NC, 1NC-1NO, 2NO, 2NC (Refer Table CPG-2)
Sensing Element: Bourdon Tube, Diaphragm
Element Materials: SS316, Monel*, SS316 (Diaphragm & Differential Types)
Movements: SS304, Brass
Connection Material: SS316, Monel*
Standard Connections: Refer Table CPG-3
Casing Options: Cast Aluminum LM6 Alloy with blow out disc.
Dimensions: Refer Table CPG-4
Dial: Aluminum matte white finish with black lettering.
Pointer: Black finished Aluminum micro adjustable.
Window Options: Toughened glass, Acrylic.
Weather Protections: IP55
Mounting Options: Refer Table CPG-5

Ordering Procedure: Computer Code Construction
(See Table CPG-6 for details)
*Please indicate additional specifications separately.

1	2	3	4	5	6	7	8

Table CPG-6: Ordering Procedure

1	2	3	4	5	6	7	8
Dial Size	**Type**	**Element Mat**	**Movement**	**Conn. Mat**	**Case**	**Entry-Mounting**	**ElectricContact**
04=100mm	PI=Industrial Type	S=SS316	S=SS304	S=SS316	A=Al Alloy	1= Bottom - Surface	MEC-O=1NO
06=150mm	SI=Chemical Seal Type	M=Monel	N=Brass	M=Monel		2= Bottom - Direct	MEC-C=1NC
	DD=Differential Type	I=SS with Silver foil**				5= Back - Flush Panel	MEC-OC=1NO,1NC
	DP=Diaphragm Type	E=SS with Teflon foil**				6= Back - Direct	MEC-CC=1NC,1NO
						7= Bottom - Pipe	MEC-OO=2NO
							MEC-CC-2NC

** Applicable Only for Diaphragm Type

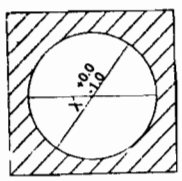
Table CPG-1: Standard Ranges

Industrial Type

Range	Kg/cm²	Bar
0 ~ 1.6	•	•
0 ~ 2.5	•	•
0 ~ 4	•	•
0 ~ 6	•	•
0 ~ 7	•	•
0 ~ 10	•	•
0 ~ 16	•	•
0 ~ 21	•	•
0 ~ 25	•	•
0 ~ 40	•	•
0 ~ 60	•	•
0 ~ 100	•	•
0 ~ 160	•	•
0 ~ 250	•	•
0 ~ 400	•	•
0 ~ 600	•	•
0 ~ 1000	•	•
-1 ~ 0.6	•	•
-1 ~ 1	•	•
-1 ~ 1.5	•	•
-1 ~ 3	•	•
-1 ~ 5	•	•
-1 ~ 6	•	•
-1 ~ 9	•	•
-1 ~ 15	•	•

Diaphragm Type

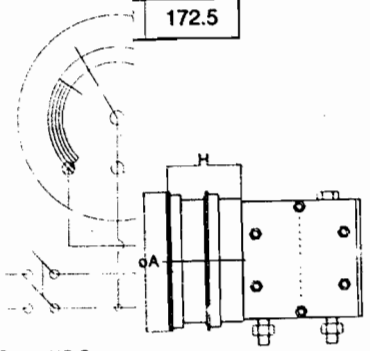
mmWC	mBa
0 ~ 1000	0 ~ 1(
0 ~ 1600	0 ~ 1(
0 ~ 2500	0 ~ 2(
0 ~ 4000	0 ~ 4(
0 ~ 6000	0 ~ 6(



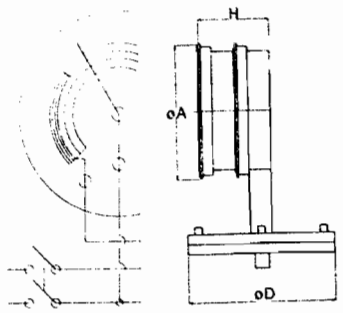
Cut Out For
Panel Mounting

Table CPG-2: Co

X
122.5
172.5



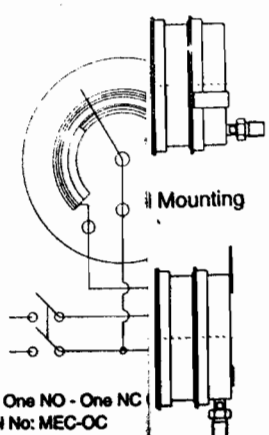
Type: Single NC Contact
Model No: MEC-C
Function: Pointer Breaks



Type: One NC - One NO
Model No: MEC-CO
Function: Pointer Breaks
Pointer Makes

Table CPG-3: Standard Process Connections

Dial Size	100mm	150mm
Connection		
1/2"NPTM	•	•
1/2"BSPM	•	•
M20*1.5 M	•	•
M18*1.5 M	•	•
3/8"NPTM	•	•
3/8"BSPM	•	•
3/8"NPTF	•	•
3/8"BSPF	•	•
1/4"NPTM	•	•
1/4"BSPM	•	•
1/4"NPTF	•	•
1/4"BSPF	•	•
1/8"NPTM	•	•
1/8"BSPM	•	•
1/8"NPTF	•	•
1/8"BSPF	•	•



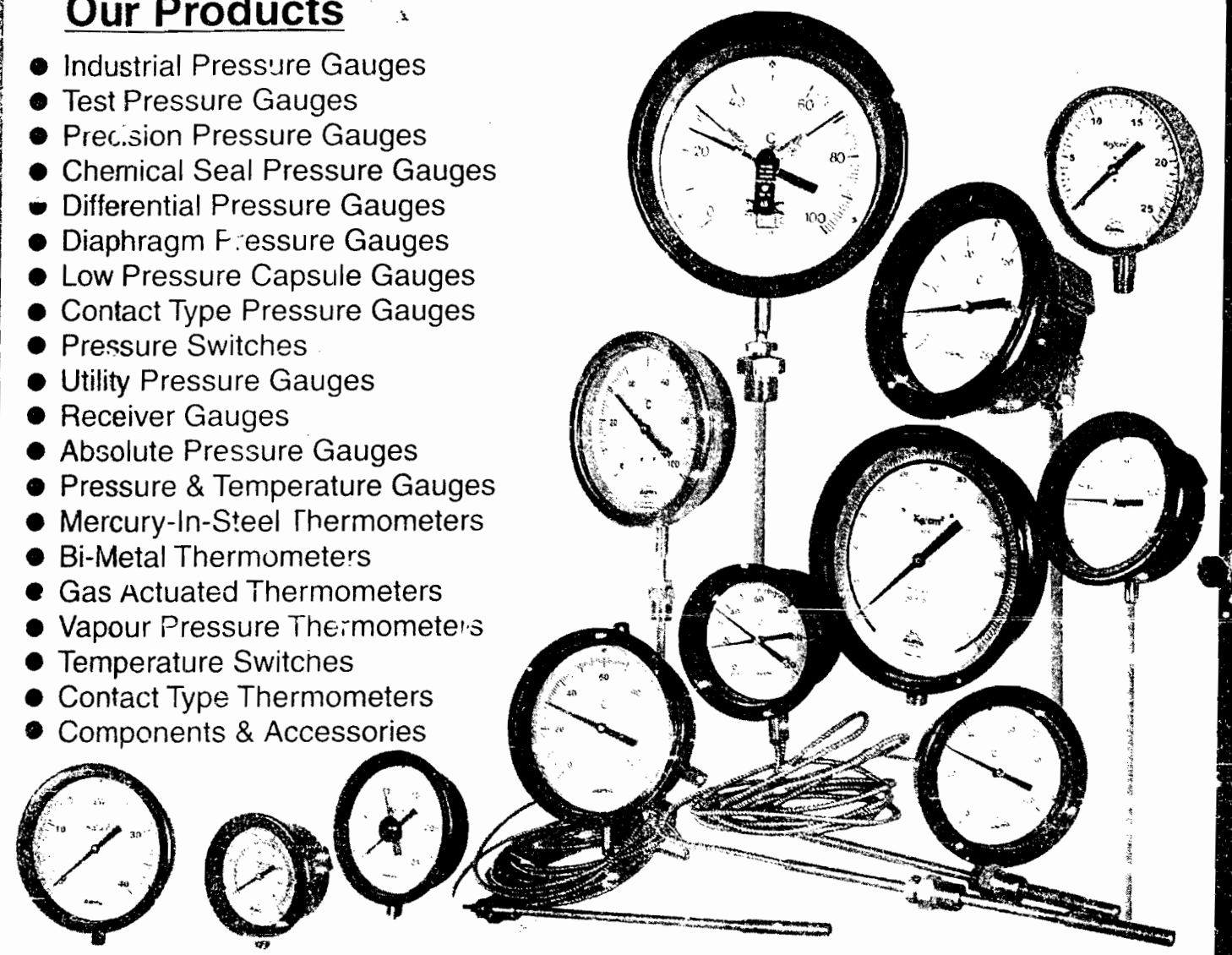
Mounting

Type: One NO - One NC
Model No: MEC-OC
Function: Pointer Makes
Pointer Breaks

face Mounting

Our Products

- Industrial Pressure Gauges
- Test Pressure Gauges
- Precision Pressure Gauges
- Chemical Seal Pressure Gauges
- Differential Pressure Gauges
- Diaphragm Pressure Gauges
- Low Pressure Capsule Gauges
- Contact Type Pressure Gauges
- Pressure Switches
- Utility Pressure Gauges
- Receiver Gauges
- Absolute Pressure Gauges
- Pressure & Temperature Gauges
- Mercury-In-Steel Thermometers
- Bi-Metal Thermometers
- Gas Actuated Thermometers
- Vapour Pressure Thermometers
- Temperature Switches
- Contact Type Thermometers
- Components & Accessories



HGuruSouth

AN ISO 9001 COMPANY

H.Guru Instruments (South India) P. Ltd.,

#32, Industrial Suburb, Yeshwantapur PO,
Bangalore-560 022, India
Phone : 91-80-3370300, 3370476, 3379568
Fax : 91-80-3379390 Online : www.hgurusouth.com
email : info@hguru...com, hgsouth@email.com

GURU SOUTH

C.E./ THERMAL DESIGN, PSEB, PATIALA

VENDOR DOCUMENTS REVIEW STATUS

1. Copies of final distribution.
2. Approved.
3. Approved except as noted. Forward final drgs. (Proceed for manufacture/construction parallely)
4. Approved except as noted rectification. Resubmission is required.
5. Not approved. See accompanying letter.
6. For information and record only.

Refer Memo No. MD........................Date..............

Approval of the Supplier's drawings by the Purchaser does not relieve the Supplier or any part of supplier's obligation to meet all the requirements of the specification. Purchase order or of the responsibility for the correctness of supplier's drawings or documents.

Action-6

	RECOMMENDED	APPROVED
AD/MD-I	DD/MD-I	DIR/MECH

TCE CONSULTING ENGINEERS LTD

VENDOR DOCUMENT REVIEW STATUS

- A. Drawing approved as submitted: proceed with fabrication/construction.
- B. Drawing approved subject to comments noted proceed with fabrication/Construction considering our comments.
- C. Our comments are noted on this marked up print
- D. Our comments are noted in memo attached to the forwarding transmittal letter No: TCE 3472A-I C-VDT/206 Dated 09.05.06
- E. Correct original of this drawing to reflect our comments and resubmit for approval.
- F. Correct original of this drawing to reflect our comments and resubmit for records.
- G. Drawings of this category are for information only and not for approval. Information as received on the drawing is noted.
- H. Drawing reviewed against our previous comments and other revisions highlighted identified by the vendor.
- I. Drawing returned without review

Approval conveyed herein neither relieves Contractor of his contractual obligations and responsibilities for correctness of dimensions, materials of construction, weights, quality, design, assembly fits, system/performance and conformity of supplies with Indian statutory as may be applicable, nor does it limit the Purchaser's rights under the contract.

Reviewed by .... Date 09.05.06

OWNER:	PUNJAB STATE ELECTRICITY BOARD PATIALA	
PROJECT:	2 X 250MW GHTP LEHRA MOHABBAT THERMAL POWER PROJECT STAGE – II, UNITS 3 & 4	
TCE OWNER'S CONSULTANT:	TCE CONSULTING ENGINEERS LIMITED BANGALORE	
भेल BHEL CONTRACTOR:	BHARAT HEAVY ELECTRICALS LTD. POWER SECTOR PROJECT ENGINEERING MANAGEMENT- NEW DELHI	
	ENGINEERING SUB CONTRACTOR:-	FICHTNER CONSULTING ENGINEERS(INDIA) PVT. LTD. CHENNAI.
BANACO VENDOR	BABUBHAI NAROTTAMDAS & CO. 'BANACO HOUSE' P-1, CAMA INDUSTRIAL ESTATE, WALBHAT ROAD, GOREGAON (EAST), MUMBAI - 400063	

Prepared by	Checked by	Approved by	TITLE: -
PBP	VKM	DRK	TEMPERATURE GAUGE

BHEL DOC NO. – PE-DC-226-174-A056	DOCUMENT NO. – BNC/A/1115/DS/40-04 (SHEET 1 OF 4)	REV. – R0

E 2 MAY 2006

3472A·619·B106·37 R0

RECORD OF REVISIONS

Rev. No.	Date	Revision Details	Revised by	Approved by
R0	05/04/06	FOR APPROVAL		

TECHNICAL DATA SHEET

BANACO
BABUBHAI NAROTAMDAS & CO.
BANACO House, P-1 Cama Ind Estate,
Walbhat Road, Goregaon (E), Mumbai - 400 063
Phone: 2685 1386, 5699 7530 Fax: 022-2665 2182

BHEL DOC NO :PE-DC-226-174-A056

DOC NO	: BNC/A/1115/DS/40-04
REV NO	: R0
DATE	: 5/4/2006
DESCRIPTION	: **Temperature Gauge** (Rigid Stem)
SHEET NO.	: 3 to 4

P&I DIAGRAM NO.		:	**BNC/4472, BNC/4475**
1.0	Make / Product Code	:	HGuruSouth/06HR2S2S2 & 6
2.0	Type	:	Mercury in steel (Rigid Stem)
3.0	Service	:	For Chlorine Liquid Pipe Mtd of CW & Caustic Tank Leak chlorine absorption system
4.0	Sensing element	:	Mercury
5.0	Dial Size	:	150MM Dia
6.0	Max. Process Temperature	:	65 Deg C
7.0	Instrument Range	:	0 - 120 Deg C
8.0	Quantity	:	3 Nos
9.0	Tag No.	:	TI-1, TI-2 & TI-7
10.0	Colour (Dial/ Numerals)	:	White/Black
11.0	Pointer Assembly	:	With Micrometer adjustment
12.0	Front Ring Assembly	:	Bayonet Lock Type
13.0	Accuracy	:	+/- 1% of Full Scale Deviation
14.0	Repeatability	:	+/-1.0% of Span
15.0	Over Range Protection	:	125% of F.S.D
16.0	Gauge Enclosure	:	IP 65 as per IS 2147
17.0	Mounting	:	Direct Bottom for TI-1 & TI-2 & Back Connection for TI-7
18.0	Bulb Diameter	:	12.0mm
19.0	Stem diameter	:	9.0mm
20.0	Immersion length	:	300mm
21.0	Extension Length	:	50mm
22.0	Total Stem length	:	350mm
23.0	Process Connection	:	1/2" NPT (M)
24.0	Thermowell process connection size and type	:	M33X2 Thread
25.0	Material of Construction		
	Case & Bezel	:	SS 304, Bayonet lock type
	Connection	:	SS 316
	Bourdon	:	SS 316
	Movement	:	SS 304
	Joint	:	Argon Arc
	Dial	:	Aluminium, black graduation on white background
	Pointer	:	Aluminium, black anodized
	window	:	Laminated Shatter Proof Glass
	Bulb & Stem	:	SS 316
	Thermowell	:	SS 316
	Blow off Disc	:	EPDM
	Gasket	:	EPDM
26.0	Test	:	As per approved QAP
27.0	Catalogue	:	Attached

TECHNICAL DATA SHEET

BANACO BABUBHAI NAROTAMDAS & CO. BANACO House, P-1 Cama Ind Estate, Walbhat Road, Goregaon (E), Mumbai - 400 063 Phone: 2685 1386, 5699 7530 Fax: 022-2685 2182	DOC NO BNC/A/1115/DS/40-04 REV NO R0 DATE 5/4/2006 DESCRIPTION **Temperature Gauge (Mercury filled)**
BHEL DOC NO :PE-DC-226-174-A056	SHEET NO. 4 OF 4

P&I DIAGRAM NO. : BNC/4472

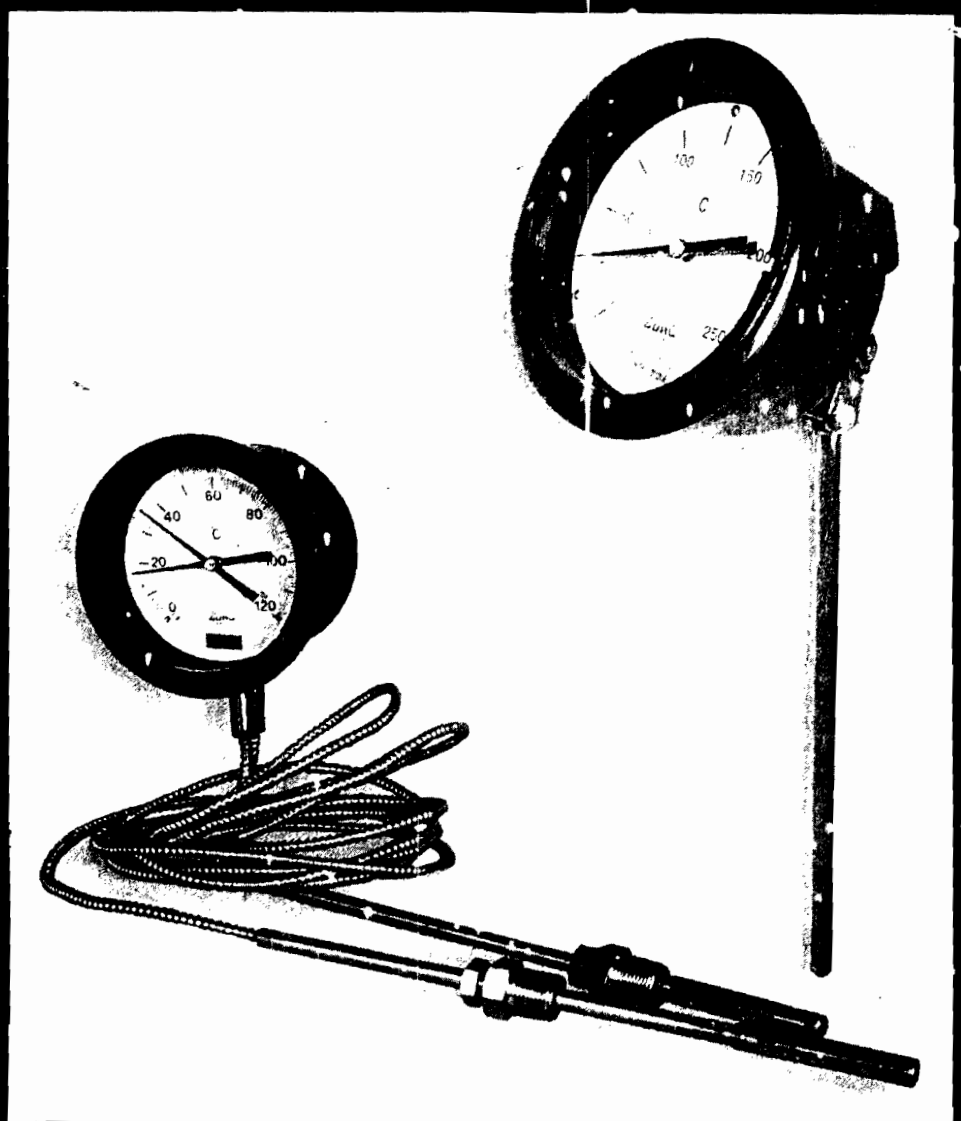
1.0	Make / Product Code	:	HGuruSouth/04HD2S2S5
2.0	Type	:	Mercury in steel (Capillary type)
3.0	Service	:	For Evaporator of CW Chlorination system
4.0	Sensing element	:	Mercury
5.0	Colour (Dial/ Numerals)	:	White/Black
6.0	Pointer Assembly	:	With Micrometer adjustment
7.0	Front Ring Assembly	:	Bayonet Lock Type
8.0	Accuracy	:	+/- 1% of Full Scale Deviation
9.0	Repeatability	:	+/-1.0% of Span
10.0	Response Time	:	2-4 SEC.
11.0	Over Range Protection	:	125% of F.S.D
12.0	Gauge Enclosure	:	IP 65 as per IS 2147
13.0	Mounting	:	Panel Mounting Back entry with Mounting Bracket
14.0	Bulb Diameter	:	14.0mm
15.0	Stem diameter	:	9.0mm
16.0	Immersion length	:	50mm
17.0	Extension Length	:	50mm
18.0	Total Stem length	:	100mm
19.0	Capillary Length	:	2 Mtr
20.0	Process Connection	:	1/2" NPT (M)
21.0	Material of Construction		
	Case & Bezel	:	SS 304, Bayonet lock type
	Connection	:	SS 316
	Bourdon	:	SS 316
	Movement	:	SS 304
	Joint	:	Argon Arc
	Dial	:	Aluminium, black graduation on white background
	Pointer	:	Micrometer Type Adjustable Pointer
	window	:	Laminated Shatter Proof Glass
	Bulb & Stem	:	SS 316
	Thermowell	:	SS 316
	Thermowell Process Connection	:	M33 X 2 Thread
	Blow off Disc	:	Ethyl Propylene Dimethyl
	Gasket	:	Ethyl Propylene Dimethyl
	Capillary	:	SS316 Capillary with SS304 Armouring

SR NO	TAG NO	QTY (Nos)	RANGE		Max. Proc. Temp.	SERVICE	Dial Size MM	Thermowell Material
			Process (Deg Cel)	Inst. (Deg Cel)	(Deg Cel)			
1	TI-3 & TI-4	2	0-75	0-120	82	Water	100	SS 316
2	TI-5 & TI-6	2	Ambient	0-120	75	Chlorine	100	SS 316

22.0	Test	:	As per approved QAP
23.0	Catalogue	:	Attached

HGuruSouth

Mercury-In-Steel Thermometers



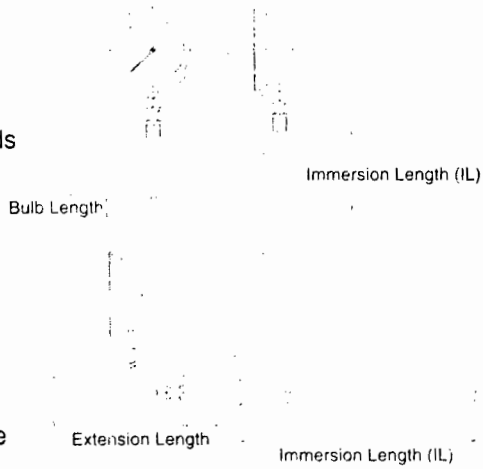
GURU SOUTH

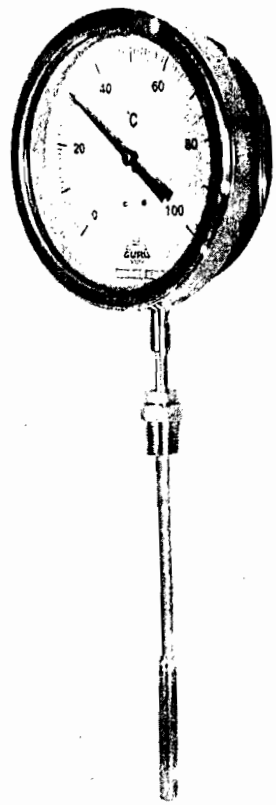
Mercury In Steel Thermometers.

Industrial Type:

These thermometers work on the principle of differential expansion between mercury and steel. The mercury is filled in the transmission line, extending into a bulb of specified volume. As the mercury in the bulb is heated, it expands and actuates a volumetric bourdon. The expansion of the bourdon is translated into a rotational motion of the pointer through a gear mechanism. These types of thermometers are active transducers and do not require any external energy source to operate. These thermometers are thus used for all general industrial applications. These gauges are extremely robust in their construction and are very well suited for field applications. These are designed for the tough industrial requirements and are characterised by:

Important Dimensions





- Bourdon Tubes made of creep resistant, low hysteresis, alloy steels.
- Capillary bore designed to reduce the temperature error over extended capillary lengths in remote operations.
- All welded construction of thermal elements.
- Bimetallic link, for compensation of measuring error due to ambient temperature around the indicating system in the case.
- Complete material guarantee.

Technical Specifications:

Dial Sizes: 63mm, 100mm, 150mm, 200mm, 250mm
Accuracy (10~90% of scale): +/- 1% FSD, +/- 1.5% FSD (DS 63mm)
Standard Ranges: Refer Table MST-1
Working Temperature Limit: ~ 70% of Scale
Over Range Protection (Short Duration Only):
25% of scale up to 300°C, 15% of scale up to 400°C, 5% of scale beyond 500°C
Temperature Error: 0.2% of scale per meter of capillary for every 10°C variation in ambient temperature from reference temperature of 25°C
Sensing Element: Bourdon
Element Materials: SS304, Cr-Mo Steel, SS316
Movements: SS304, Brass, SS316
Bulb & Stem Material: SS316, MS, Monel
Standard Bulb Diameter: 6mm, 8mm, 10mm, 12mm, 14mm, 16mm, 18mm, 20mm.
Immersion Length: Refer table MST-1
Process Connection: Gland Nut, Screw Thermowell, Flange Thermowell.
Connection Material: SS316, Monel, TW spec. and materials listed in append x.
Standard Connections: Refer Table MST-2 (Gland Nut)
Casing Options: Cast Aluminum LM6 Alloy, Stainless Steel (Refer Table MST-3)
Dial: Aluminum matte white finish with black lettering.
Pointer: Black finished Aluminum micro adjustable.
Window Options: Glass, Shatter proof glass, Toughened glass, Acrylic.
Weather Protections: IP55, IP65.
Mounting Options: Refer Table MST-4
Capillary Options: Refer Table MST-5
Capillary Length: Max. 20m

Optional Extras:
- Liquid Filling In Case.
- Drag Pointer
- Custom Dial Executions.
- Dual Scale
- Special Ranges

Mercury In Steel Thermometers.

Industrial Type:

These thermometers work on the principle of differential expansion between mercury and steel. The mercury is filled in the transmission line, extending into a bulb of specified volume. As the mercury in the bulb is heated, it expands and actuates a volumetric bourdon. The expansion of the bourdon is translated into a rotational motion of the pointer through a gear mechanism. These types of thermometers are active transducers and do not require any external energy source to operate. These thermometers are thus used for all general industrial applications. These gauges are extremely robust in their construction and are very well suited for field applications. These are designed for the tough industrial requirements and are characterised by:

- Bourdon Tubes made of creep resistant, low hysteresis,
- Capillary bore designed to reduce the temperature error in remote operations.
- All welded construction of thermal elements.
- Bimetallic link, for compensation of measuring error due the indicating system in the case.
- Complete material guarantee.

Technical Specifications:

Dial Sizes: 63mm, 100mm, 150mm, 200mm, 250mm
Accuracy (10~90% of scale): +/- 1% FSD, +/- 1.5% FSD (
Standard Ranges: Refer Table MST-1
Working Temperature Limit: ~ 70% of Scale
Over Range Protection (Short Duration Only):
% of scale up to 300°C, 15% of scale up to 400°C, 5%
Temperature Error: 0.2% of scale per meter of capillary fo
from reference temperature of 25°C
Sensing Element: Bourdon
Element Materials: SS304, Cr-Mo Steel, SS316
Movements: SS304, Brass, SS316
Bulb & Stem Material: SS316, MS, Monel®
Standard Bulb Diameter: 6mm, 8mm, 10mm, 12mm, 14m
Immersion Length: Refer table MST-1
Process Connection: Gland Nut, Screw Thermowell, Flar
Connection Material: SS316, Monel®, TW spec. and mat
Standard Connections: Refer Table MST-2 (Gland Nut)
Casing Options: Cast Aluminum LM6 Alloy, Stainless Ste
Dial: Aluminum matte white finish with black lettering.
Pointer: Black finished Aluminum micro adjustable.
Window Options: Glass, Shatter proof glass, Toughened
Weather Protections: IP55, IP65.
Mounting Options: Refer Table MST-4
Capillary Options: Refer Table MST-5
Capillary Length: Max. 20m

he pointer was last reset. They are engaged by a small
s an index pointer, which acts as a guide to the plant
lastic window adjustable from front, by using a screw

Impor

into consideration, and after ascertaining their

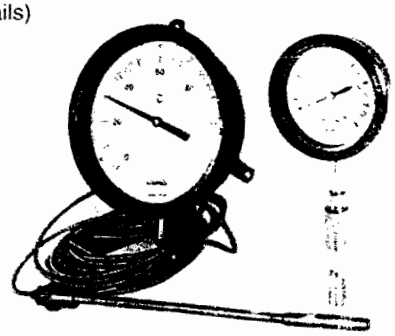
conjuncture with thermowells. Thermowells must
ssure, temperature, chemical nature of process

void any accidental error during transport.
ceed 70 ~ 75% of scale, and not drop below the

the lower side and 650°C on the higher side.

Bulb Length

ST-6 for details)



Extensic

5	6	7	8
ement & Mvmt. Mat	Case	Entry-Mounting	Accessories
1=SS304 & Brass	A=Al Alloy	1= Bottom - Surface	GF=Glycerine Fill
2=SS316 & SS304	S=SS	2= Bottom - Direct	SF=Silicone Fill
Cr-Mo Steel & Brass	P= Phenolic	3= Bottom - Surface Yoke	DP=Drag Pointer
Cr-Mo Steel & SS304		4= Bottom - Pipe Yoke	
5=SS316 & SS316		5= Back - Flush Panel	
6=SS304 & SS304		6= Back - Direct	
		8= Bottom - 90° Direct	
		9= Bottom - 120° Direct	
		0= Bottom - 160° Direct	
		V= Bottom-Spring Mounted	
		A= Back - All Angle	

easily read.
very useful
for easy

ction.

Compact Type:

These temperature gauges are used in applications, wh
glass thermometers are traditionally used, such as in sn
pipelines. These offer a distinct advantage over liquid in
thermometers in terms of their readability. The indicating
makes reading much easier, and more accurate. These
do not require the use of protective thermowells, and ca
directly. The orientation of the head is done through a uni
which allows for pressure sealing. They can also be use
with high vibration levels with the use of liquid filling with

y 10°C variation in ambient temperature

Technical Specifications:

Dial Sizes: 63mm
Accuracy (10- 90% of scale): +/- 2% FSD
Standard Ranges: Refer Table MST-7 (Refer Table MST-15)
Working Temperature Limit: ~ 70% of Scale
Over Range Protection (Short Duration Only): 20% of
Sensing Element: Bourdon
Element Materials: Cr-Mo Steel 6mm, 18mm, 20mm.
Movements: SS304, Brass
Bulb & Stem Material: SS316, MS, Monel® hermowell.
Bulb Diameters: 10mm, 12mm, 14mm, 16mm, 18mm, 2 listed in appendix.
Immersion Length: Please Refer Table MST-7
Process Connection: Threaded efer Table MST-10)
Connection Material: SS316, Monel
Standard Connections: Refer Table MST-8
Casing Options: Cast Aluminum LM6 Alloy s, Acrylic.
Dial: Aluminum matte white finish with black lettering.
Pointer: Black finished Aluminum micro adjustabie.
Window Options: Glass, Shatter proof glass, Toughenec
Weather Protections: IP55
Mounting Options: Bottom Entry Direct Mounting, Back

Note: Table MST-12 for details)
Please make sure that the process connection joint d
Please select material after considering all the param
specific application.

Please follow the ordering procedure mentioned earlier ir

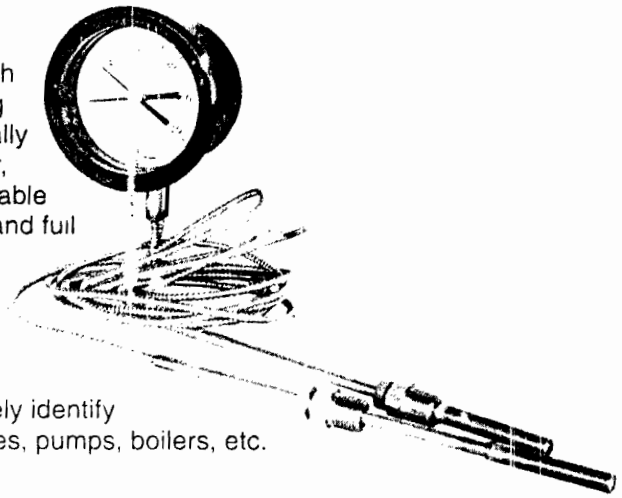
Contact Type Thermometers:

Contact type temperature gauges are used in controlling a
temperature equipment. These gauges incorporate tempe
with electric contact systems. The contacts have either on
pointers, which traverse over the instrument's dial. The cor
by a pin mounted on the indicating pointer of the instrume
of the set pointers is achieved by means of a adjusting arm
window of the instrument. These contact systems generate
signals at certain preset pressure which can be transmitte
control lights, motors, solenoid valves etc.

These are suitable for applic..tion in most general industria
plants, storage tanks, steam generators, turbine equipmen

5	6	7	8
Mvmt. Mat	Case	Entry-Mounting	Electric Contact
& Brass	A=Al Alloy	1= Bottom - Surface	MEC-C=1NC
& SS304		2= Bottom - Direct	MEC-O=1NO
eel & Brass		5= Back - Flush Panel	MEC-OC=1NO,1NC
el & SS304		6= Back - Direct	MEC-CO=1NC,1NO
& SS316		8= Bottom - 90° Direct	MEC-CC=1NC
& SS304		9= Bottom - 120° Direct	MEC-CC=2NO
		0= Bottom - 160° Direct	

Twin Pointer Differential Temperature Gauge:



These gauges are used for simultaneously monitoring the high and low temperatures on the same dial through two indicating pointers. The two pointers indicate the temperatures individually and thus show the two temperatures in relation to each other, the difference being the gap between the two. These are suitable for most general industrial applications. These gauges withstand full working temperature, applied separately or together.

These gauges are very useful for process applications as the operator can visualize the relation between the two temperatures. If, in any case, one of the temperature sources is behaving in an erratic manner, the operator can immediately identify it, and take corrective measures. Ex. Inlet and outlet of turbines, pumps, boilers, etc.

Technical Specifications:

Dial Sizes: 100mm
Accuracy (10~90% of scale): +/- 1% FSD
Standard Ranges: Refer Table MST-1
Working Temperature Limit: ~ 70% of Scale
Over Range Protection (Short Duration Only):
25% of scale up to 300 C, 15% of scale up to 400 C , 5% of scale beyond 500 C
Temperature Error: 0.2% of scale per meter of capillary for every 10 C variation in ambient temperature from reference temperature of 25 C
Sensing Element: Twin Bourdon
Immersion Length: Refer table MST-1
Casing Options: Cast Aluminum LM6 Alloy (Refer Table MST-13)
Mounting Options: Refer Table MST-14
Capillary Options: Refer Table MST-5
Capillary Length: Max. 20m

***All Other Specifications as in Industrial Range**
***Ordering Procedure as in Industrial Range**
*Liquid Filling is not applicable

Table MST-1: Standard Ranges and IL

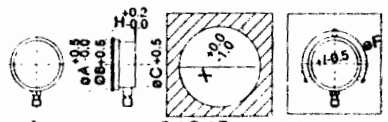
	Minimum Immersion Length (IL) (mm)							
BulbDia.(mm)	6	8	10	12	14	16	18	20
Ranges (C)								
0 ~ 50	980	446	260	174	127	98	80	67
0 ~ 80	620	287	170	126	87	69	57	50
0 ~ 100	500	233	140	97	73	60	50	44
0 ~ 120	420	198	120	84	64	52	45	40
0 ~ 150	340	162	100	71	55	46	40	35
0 ~ 200	294	126	80	58	46	40	35	32
0 ~ 250	212	105	68	51	41	35	32	29
0 ~ 300	180	90	60	45	37	33	30	27
0 ~ 400	140	73	50	39	33	29	27	25
0 ~ 500	115	62	44	35	30	27	25	23
0 ~ 600	100	55	40	32	28	26	24	22
0 ~ 650	93	52	38	32	28	26	23	21
-30 ~ 50	620	287	170	126	87	69	57	50
-10 ~ 90	500	233	140	97	73	60	50	44
-30 ~ 120	340	162	100	71	55	46	40	35
-50 ~ 650	93	52	38	32	28	26	23	21

Table MST-2 Standard Connections

Connection
1"NPTM
1"BSPM
3/4"BSPM
3/4'NPTM
1/2"NPTM
1/2"BSPM
M33*2 M
M20*1.5 M
M18*1.5 M
3/3"NPTM
3/8"BSPM
3/8"NPTF
3/8"BSPF

Table MST-3: Case Dimensions

Cast Al LM6 Alloy Case



Cut Out For Panel Mounting

PCD of Fixing Holes For Surface Mounting

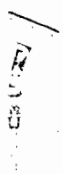
DIAL SIZE	A	B	C	H	X	F
63	78.5	75	67.5	41.5	76	98
100	128.5	120.5	106.5	50.5	122.5	141.5
150	178.5	170.5	157.5	59.5	172.5	191.5
200	226.5	217.5	204.5	60	218.5	238
250	282.5	274.5	259.5	60.5	276.5	291.5

ALL DIMENSIONS ARE IN MM

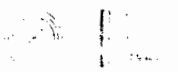
Table MST-4: Mounting Options

BOTTOM ENTRY
DIRECT MOUNTING

BOTTOM ENTRY
SURFACE MOUNTING



BACK ENTRY
ALL ANGLE MOUNTING



BACK ENTRY
DIRECT MOUNTI

Cut Out For
Panel Mounting

Table MST-5: Capillary Options

- Mild Steel With Copper Sheathing
- Mild Steel With Copper and PVC Sheathing
- Mild Steel With SS304 / SS316 Sheathing
- SS316
- SS316
- SS316

Table MST-7: Standard Ranges and IL (Compac

Bulb Dia. (mm)	10	12	14	16
Ranges (°C)				
0 ~ 50	250	164	117	8
0 ~ 80	160	116	77	5
0 ~ 100	130	87	63	5
0 ~ 120	110	74	54	4
0 ~ 150	90	61	55	
0 ~ 200	70	48	36	
0 ~ 250	58	41	31	
0 ~ 300	50	35	27	

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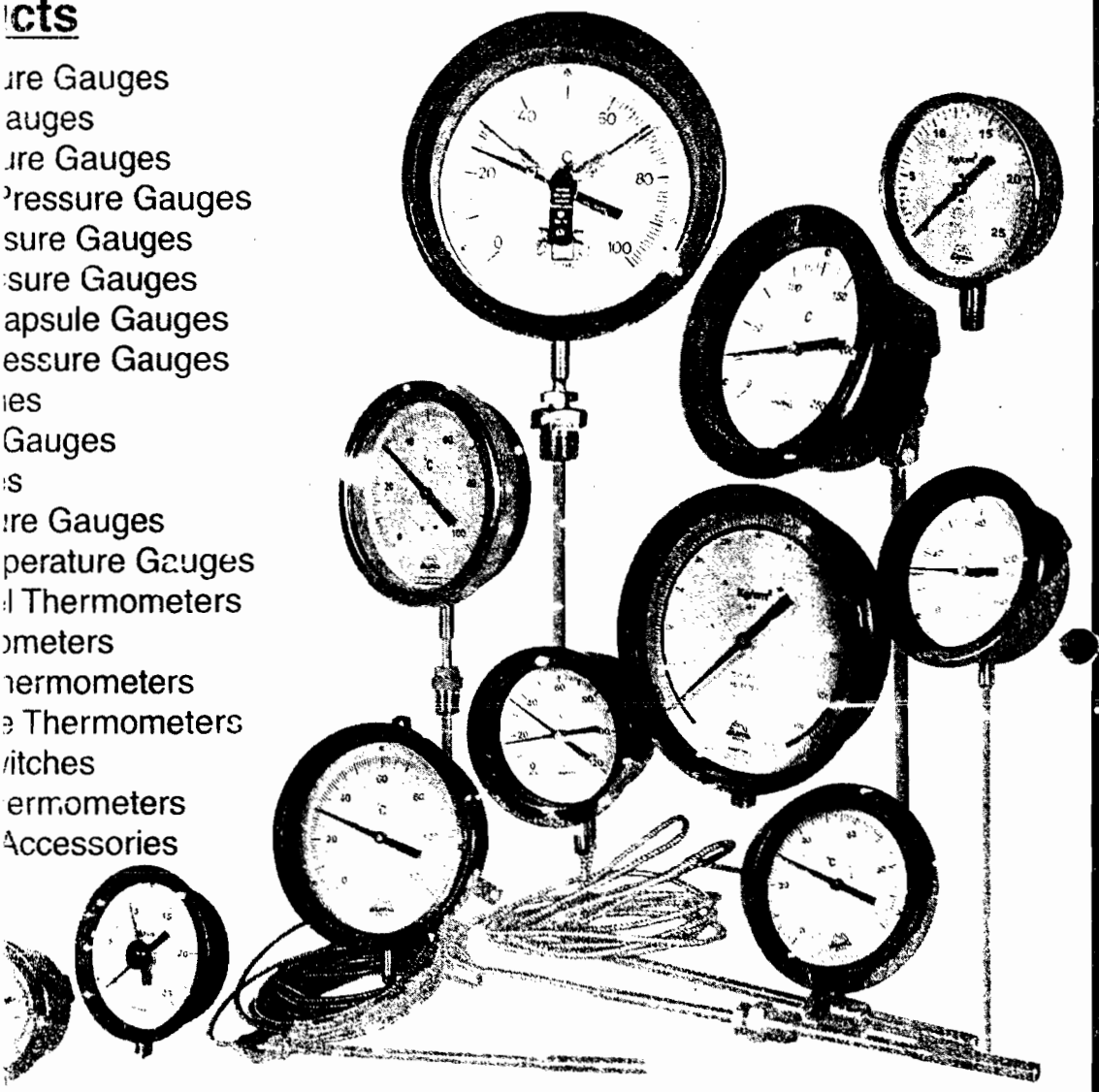
Accessories



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HGuruSouth

AN ISO 9001 COMPANY

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Fax : 91 80 3379890 Online : www.hgurusouth.com
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C.E.(THERMAL DESIGN, PSEB, PATIALA

VENDOR DOCUMENTS REVIEW STATUS

1. Copies of final distribution.
2. Approved. Action-6
3. Approved except as noted. Forward final drgs. (Proceed for manufacture/construction parallely)
4. Approved except as noted rectification. Resubmission is required.
5. Not approved. See accompanying letter.
6. For information and record only.

Refer Memo No. MD.....Date.....

Approval of the Supplier's drawings by the purchaser does not relieve the Supplier or any part of supplier's obligation to meet all the requirements of the specification. Purchase order or of the responsibility for the correctness of the supplier's drawings or documents.

CHECKED	RECOMMENDED	APPROVED
AD/MD-I	DD/MD-I	DIR/MECH

TCE CONSULTING ENGINEERS LTD.

VENDOR DOCUMENT REVIEW STATUS

- [x] A. Drawing approved as submitted: proceed with fabrication/construction.
- [ ] B. Drawing approved subject to comments noted proceed with fabrication/Construction considering our comments.
- [ ] C. Our comments are noted on this marked up print.
- [ ] D. Our comments are noted in memo attached to the forwarding transmittal letter No. TCE 3472A-IC-VDT/206 Dated 09.05.06
- [ ] E. Correct original of this drawing to reflect our comments and resubmit for approval.
- [ ] F. Correct original of this drawing to reflect our comments and resubmit for records.
- [ ] G. Drawings of this category are for information only and not for approval. Information furnished on the drawing is noted.
- [x] H. Drawing reviewed against our previous comments and other revisions highlighted and identified by the vendor.
- [ ] I. Drawing returned without review.

Approval conveyed herein neither relieves Vendor / Contractor of his contractual obligations and his responsibilities for correctness of dimensions, materials of construction, weights, quantities, design details, assembly fits, system performance requirements and conformity of supplies with Indian statutory Laws as may be applicable, nor does it limit the Purchaser's rights under the contract.

Reviewed by Veera Date 09.05.06

OWNER:	PUNJAB STATE ELECTRICITY BOARD PATIALA
PROJECT:	2 X 250MW GHTP LEHRA MOHABBAT THERMAL POWER PROJECT STAGE – II, UNITS 3 & 4
OWNER'S CONSULTANT:	TCE CONSULTING ENGINEERS LIMITED BANGALORE
CONTRACTOR:	BHARAT HEAVY ELECTRICALS LTD. POWER SECTOR PROJECT ENGINEERING MANAGEMENT- NEW DELHI
ENGINEERING SUB CONTRACTOR:-	FICHTNER CONSULTING ENGINEERS(INDIA) PVT. LTD. CHENNAI.
VENDOR	BABUBHAI NAROTTAMDAS & CO. 'BANACO HOUSE' P-1, CAMA INDUSTRIAL ESTATE, WALBHAT ROAD, GOREGAON (EAST), MUMBAI - 400063

Prepared by	Checked by	Approved by	TITLE: -
PBP	VKM	DRK	PRESSURE GAUGE

BHEL DOC NO. –	DOCUMENT NO. –	REV. –
PE-DC-226-174-A055	BNC/A/1115/DS/40-03 (SHEET 1 OF 6)	R0

E 2 MAY 2006

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RECORD OF REVISIONS

Rev. No.	Date	Revision Details	Revised by	Approved by
R0	05/04/06	FOR APPROVAL		

TECHNICAL DATA SHEET

BANACO
BABUBHAI NAROTAMDAS & CO.
BANACO House, P-1 Cama Ind Estate,
Wa'bhat Road, Goregaon (E), Mumbai - 400 063
Phone: 2685 1386, 5699 7530 Fax: 022-2685 2182

DOC NO	: BNC/A/1115/DS/40-03
REV NO	: R0
DATE	: 5/4/2006
DESCRIPTION	: **PRESSURE GAUGES**
BHEL DOC NO :PE-DC-226-174-A055	SHEET NO. : 3 of 6

P&I DIAGRAM NO. : BNC/4472, BNC/4473,BNC/4474 & BNC/4475

1.0	Make	: HGuruSouth
2.0	Type	: Direct Sensing
3.0	Product Code	: 06PISSSS2-Range for 150 mm Dial 04PISSSS3-Range for 100 mm Dial 06DPSSSS2- Range for 150mm Dial PI-24 & 25 tag Nos
4.0	Service	: For CW, RW,PW & Leak chlorine absorption system
5.0	Presssure Element	: Bourdon
6.0	Dial Size	: Dial Size of 150 MM will be used for line mounted Pressure Gauge & Dial Size of 100 MM shall be used for Chlorinator & Evaporator Gauges
7.0	Colour (Dial/ Numerals)	: White/Black
8.0	Pointer Assembly	: Black finished aluminium micro adjustable
9.0	Front Ring Assembly	: Bayonet Lock Type
10.0	Accuracy	: +/- 1.0% of Full Scale Deviation(With out chemical seal) +/- 1.5% of Full Scale Deviation(with chemical seal)
11.0	Repeatability	: +/- 1.0% of Span
12.0	Over Range Protection	: 125% of F.S.D
13.0	Gauge Enclosure	: IP 65 as per IS 2147
14.0	Case Colour / Finish	: NA
15.0	Blow Out Disc	: Provided
16.0	Location / Orientation of Process Connection	: Bottom / Back
17.0	Process Connection	: 1/2" NPT (M)
18.0	PROCESS TEMPARATURE UP TO WHICH GAUGE CAN WITH STAND WITH OUT DAMAGING BOURDON.	: 170°c

TECHNICAL DATA SHEET

BANACO
BABUBHAI NAROTAMDAS & CO.
BANACO House, P-1 Cama Ind Estate,
Walbhat Road, Goregaon (E), Mumbai - 400 063
Phone: 2685 1386, 5699 7530 Fax: 022-2685 2182

DOC NO	: BNC/A/1115/DS/40-03
REV NO	: R0
DATE	: 5/4/2006
DESCRIPTION	: PRESSURE GAUGES
BHEL DOC NO :PE-DC-226-174-A055	SHEET NO. : 4 of 6

P&I DIAGRAM NO. : BNC/4472, BNC/4473,BNC/4474 & BNC/4475

19.0	Ambient Temperature	: -25°c to 65°c
20.0	Design Temperature	: -28 to +270^0 C
21.0	Design Pressure	: 30% for pressure range <60 bar
22.0	**Material of Construction**	
22.1	Case & Bezel	: SS 304 Baynote Lock Type
22.2	Bourdon	: SS 316
22.3	Movement	: SS 304
22.4	Socket	: SS 316
22.5	Joint	: Argon Arc Welding
22.6	Dial	: Aluminium Black Graduation on White Background
22.7	Pointer	: Aluminium Black coloured, Micrometer Zero Adjustable
22.8	Gasket	: EPDM
22.9	Window	: Laminated Shatterproof Glass
22.10	Blow off Dics	: EPDM
23.0	**CHEMICAL SEAL (For Chlorine & Caustic)**	
23.1	Make	: BANACO
23.2	Top chamber	: SA 105
23.3	Bottom Chamber	: SA 105
23.4	Sensing	
	For Chlorine liquid & GasServi	: Silver Diaphram transmitting the pressure to the bourdon tube through anti-corrosive sealing fluid (Silicon Oil)
	For Caustic Services	: AISI 316 Diaphram transmitting the pressure to the bourdon tube through anti-corrosive sealing fluid (Silicon Oil)

TECHNICAL DATA SHEET

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BABUBHAI NAROTAMDAS & CO.
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Walbhat Road, Goregaon (E), Mumbai - 400 063
Phone: 2685 1386, 5699 7530 Fax: 022-2685 2182

DOC NO	: BNC/A/1115/DS/40-03
REV NO	: R0
DATE	: 5/4/2006
DESCRIPTION	PRESSURE GAUGES
BHEL DOC NO :PE-DC-226-174-A055	SHEET NO. : 5 of 6
P&I DIAGRAM NO.	: BNC/4472, BNC/4473,BNC/4474 & BNC/4475

24.0 SNUBBER (For Pressure Guages Tag Nos :PI-11,PI-12,PI-20,PI-21)

24.1	Make	: HGuruSouth
24.2	Model	: SNS1601
24.3	Working Pressure	: Upto 160 Bar
24.4	Working temperature	: -10 to 180 Deg Cel
24.5	Wetted Parts	: AISI 316
24.6	Type	: Throttle Adjustable type

TECHNICAL DATA SHEET

BANACO
BABUBHAI NAROTAMDAS & CO.
BANACO House, P-1 Cama Ind Estate,
Walbhat Road, Goregaon (E), Mumbai - 400 063
Phone: 2685 1386, 5699 7530 Fax: 022-2685 2182

DOC NO	:	BNC/A/1115/DS/40-03
REV NO	:	R0
DATE	:	5/4/2006
DESCRIPTION	:	PRESSURE GAUGES
SHEET NO.	:	6 of 6

BHEL DOC NO :PE-DC-226-174-A055

P&I DIAGRAM NO. : BNC/4472, BNC/4473,BNC/4474 & BNC/4475

PRESSURE GUAGES FOR CW, RW & PW CHLORINATION SYSTEM

CW CHLORINATION SYSTEM

SR NO	TAG NO	QTY (Nos)	Range		Max. Process Pressure (Kg/Sq.Cm)	FLUID	Dial Size (mm)	SEAL MATERIAL & TYPE OF SEAL
			Process (Kg/Sq.Cm)	Instrument (Kg/Sq.Cm)				
1	PI-1 & PI-2	2	0-10	0-40	14	Liquid Chlorine	150	Silver, Diaphragm type
2	PI-3 & PI-4	2	0-10	0-40	28	Gas Chlorine	100	Silver, Diaphragm type
3	PI-5 & PI-6	2	0-10	0-40	28	Gas Chlorine	150	Silver, Diaphragm type
4	PI-7 & PI-8	2	0-2	0-16	10	Gas Chlorine	150	Silver, Diaphragm type
5	PI-9 & PI-10	2	0-2	0-16	10	Gas Chlorine	100	Silver, Diaphragm type
6	PI-11 & PI-12	2	0-5	0-10	5.3	Water	150	NA
7	PI-13 & PI-14	2	0-2	0-4	2	Water	150	NA
9	VI-1 & VI-2	2	600 mm of Hg	0 to 760 mm Hg	700 mm of Hg	Gas Chlorine	100	Silver Diaphragm type

RW CHLORINATION SYSTEM

SR NO	TAG NO	QTY (Nos)	Range		Max. Process Pressure (Kg/Sq.Cm)	FLUID	Dial Size (mm)	SEAL MATERIAL & TYPE OF SEAL
			Process (Kg/Sq.Cm)	Instrument (Kg/Sq.Cm)				
1	PI-15 & PI-16	2	0-10	0-16	10	Gas Chlorine	150	Silver, Diaphragm type
2	PI-17	1	0-10	0-16	10	Gas Chlorine	150	Silver, Diaphragm type
3	PI-18 & PI-19	2	0-2	0-16	10	Gas Chlorine	100	Silver, Diaphragm type
4	PI-20 & PI-21	2	0-5	0-10	5.1	Water	150	NA
5	VI-3 & VI-4	2	600 mm of Hg	0 to 760 mm Hg	700 mm of Hg	Gas Chlorine	100	Silver Diaphragm type

CHLORINE LEAK ABSORPTION FOR CW CHLORINATION SYSTEM

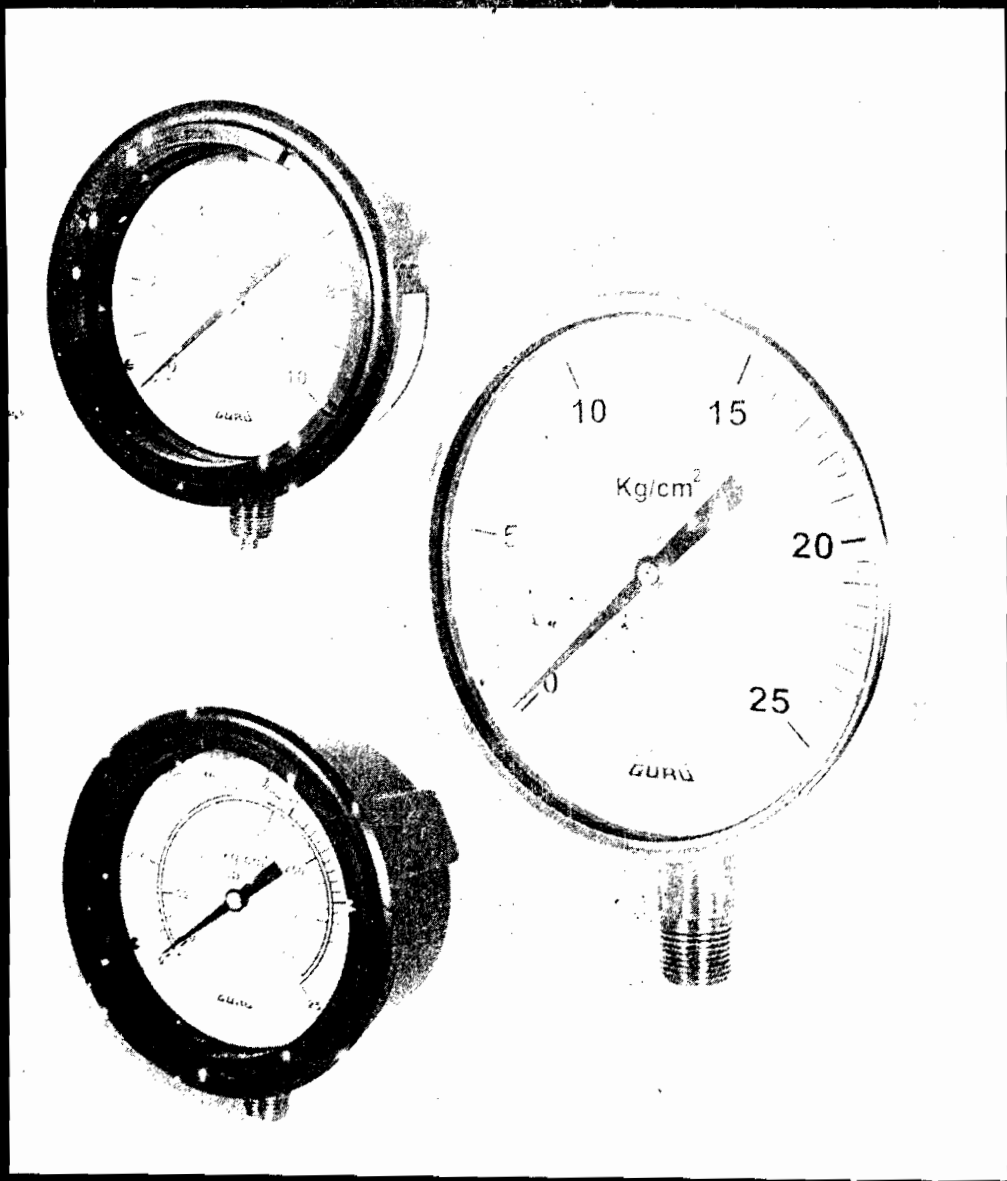
SR NO	TAG NO	QTY (Nos)	Range		Max. Process Pressure (Kg/Sq.Cm)	FLUID	Dial Size (mm)	SEAL MATERIAL & TYPE OF SEAL
			Process (Kg/Sq.Cm)	Instrument (Kg/Sq.Cm)				
1	PI-22 & PI-23	2	0-1.5	0-4	1.8	Caustic Soln	150	SS316, Diaphragm type
2	PI-24 & PI-25	2	0-250MM WG	0-600MMWG	250MMWG	Air + Chlorine gas	150	SS316, Diaphragm type

PW CHLORINATION SYSTEM

SR NO	TAG NO	QTY (Nos)	Range		Max. Process Pressure (Kg/Sq.Cm)	FLUID	Dial Size (mm)	SEAL MATERIAL & TYPE OF SEAL
			Process (Kg/Sq.Cm)	Instrument (Kg/Sq.Cm)				
1	PI-26 & PI-27	2	0-5	0-10	5	Hypochlorite Soln	150	SS316, Diaphragm type

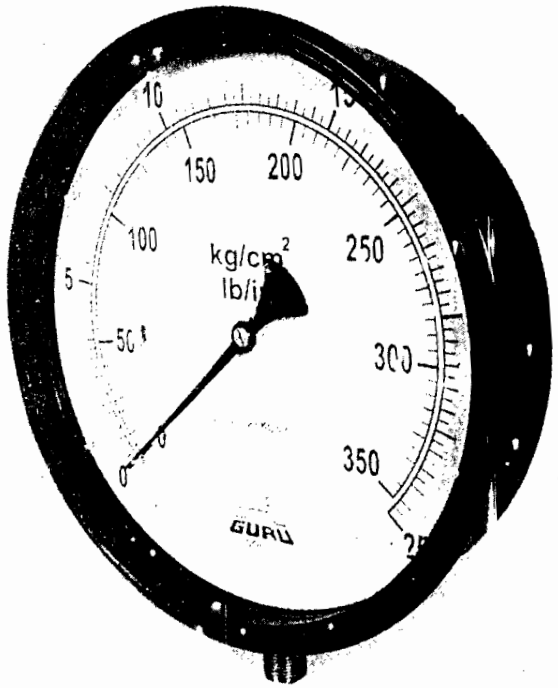
HGuruSouth

Industrial Pressure Gauges



GURU SOUTH

Industrial Pressure Gauges:



Standard Range:

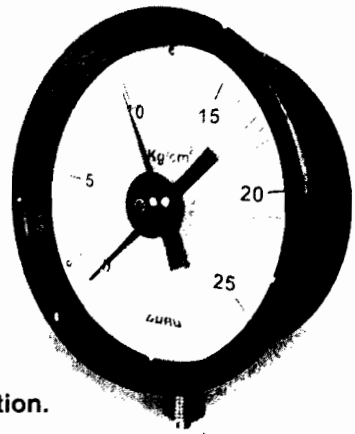
H.Guru South 'Industrial Pressure Gauges' are suitable for all general industrial applications. They are robust in their construction and are ideal for field applications. These gauges come with bourdon tube sensing elements. They have guaranteed initial accuracy and repeatability. The accuracy is maintained longer, a result of a sound design and fabrication of all the critical components, in house. The design incorporates a blow out disc in order to maintain safety. These gauges are available with material and calibration certificates. Performance is as per IS 3624-1987. They are available in a variety of casing options to suite most environments and applications.

Technical Specifications:
Dial Sizes: 100mm, 150mm, 200mm, 250mm, 300mm
Accuracy (10~90% of scale): +/- 1% FSD
Standard Ranges: Refer Table PGI-1
Working Pressure: 10 ~ 70% of Scale (Steady Pressure)
10 ~ 50% of Scale (Fluctuating Pressure)
Over Pressure Protection:
30% of scale up to 60Kg/cm² ; 25% of scale up to 100Kg/cm² ; 15% of scale above 100Kg/cm²
Operating Temperature: -29 C ~ 270 C
Ambient Temperature: -25 C ~ 65 C
Temperature Error: (Reference Temperature = 25 C)
+0.3% of scale for every 10 C increase from reference temperature.
- 0.3% of scale for every 10 C decrease from reference temperature.
Sensing Element: Bourdon Tube
Element Materials: SS316, Monel*
Movement: SS304, Brass
Connection Material: SS316, Monel*
Standard Connections: Refer Table PGI-2
Casing Options: Cast Aluminum LM6 Alloy, Stainless Steel with blow out disc. (Refer Table PGI-3 for details)
Dial: Aluminum matte white finish with black lettering.
Pointer: Black finished Aluminum micro adjustable.
Window Options: Glass, Shatter proof glass, Toughened glass, Acrylic.
Weather Protections: IP55, IP65.
Mounting Options: Refer Table PGI-4
Approximate Weight: Refer Table PGI-5

Optional Extras:
- Electric Contacts (DS 100mm & 150mm) (Accuracy +/-1.5%)
- Drag Pointer**
- Material Options
- Cleaning for Oxygen, Acetylene, or other special services.
- Special Ranges & Scales : PSI, MPa, KPa etc.

Custom made Dials with special markings.
Applicable Accessories

** This red pointer (shown here in grey) shows the maximum value attained since the pointer was last reset. They are engaged by a small pin on this pointer. If this pointer is omitted, this pointer becomes an index pointer, which acts as a guide to the plant attendant. This pointer assembly is mounted on an acrylic plastic window adjustable from front, by using a screw driver through an adjustable screw.



Note:

- **Industrial Type is suitable for corrosive environments where the fluid medium does not clog the connection or the element, or corrode the wetted parts. Please refer the corrosion chart provided in this section.**
- **Please ascertain the suitability of material to the specific application.**

Phenolic Case Pressure Gauge:

These gauges are typically used in very harsh and highly corrosive environments. They are used in chemical, fertilizer and petrochemical industries due to their tolerance to the corrosive environments that such industries offer.

Additional Technical Specifications:
Dial Sizes: 150mm
Operating Temperature: -29 C ~ 150 C
Case: Phenolic
*All Other Specifications as in Standard Range.

Ordering Procedure: Computer Code Construction (See Table PGI-6 for details)
*Please indicate additional specifications separately.

P —

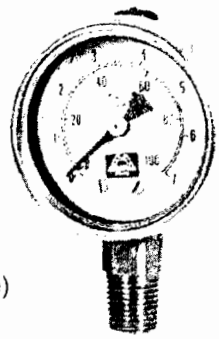
1 2 3 4 5 6 7 8

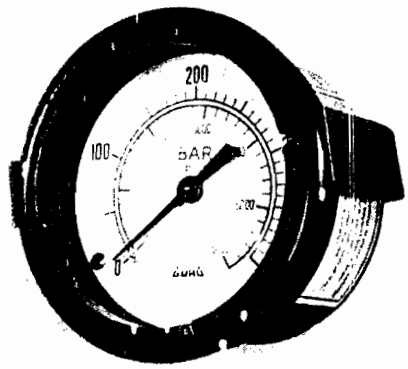
Table PGI-6: Ordering Procedure

1	2	3	4	5	6	7	8
Dial Size	**Type**	**Element Mat**	**Movement**	**Conn. Mat**	**Case**	**Entry-Mounting**	**Accessories**
04=100mm	I= Industrial	S=SS316	S=SS304	S=SS316	A=Al Alloy	1= Bottom - Surface	Please Refer
06=150mm	S= Solid Front	M=Monel	N=Brass	M=Monel	S=SS	2= Bottom - Direct	Accessory Section
08= 200mm					P= Phenolic	5= Back - Flush Panel	
10= 250mm						6= Back - Direct	
12= 300mm						7= Bottom - Pipe	

Mini Range:

The Mini range of industrial pressure gauges essentially includes the small dial size range of gauges suitable for general industrial applications.





Technical Specifications:
Dial Sizes: 50mm, 63mm
Accuracy (10~90% of scale): +/- 1.5% FSD
Standard Ranges: Refer Table PGI-1
Working Range: 10 ~ 70% of Scale (Steady Pressure)
10 ~ 50% of Scale (Fluctuating Pressure)
Sensing Element: Bourdon Tube
Element Materials: SS316
Movements: SS304, Brass
Connection Material: SS316
Standard Connections: Refer Table PGI-2
Casing Options: Cast Aluminum LM6 Alloy, Stainless Steel (Refer Table PGI-3 for details)
Dial: Aluminum matte white finish with black lettering.
Pointer: Black finished Aluminum nonadjustable.
Window Options: Glass, Shatter proof glass, Toughened glass, Acrylic.
Weather Protections: IP55, IP65.
Mounting Options: Refer Table PGI-4
Approximate Weight: Refer Table PGI-5

***All other specifications as in Standard Range**

Optional Extras:
- Cleaning for Oxygen, Acetylene, or other special services.
- Special Ranges & Scales : PSI, MPa, KPa etc.
- Custom made Dials with special markings.
- Applicable Accessories

Ordering Procedure: Computer Code Construction (See Table PGI-8 for details)
*Please indicate additional specifications separately.

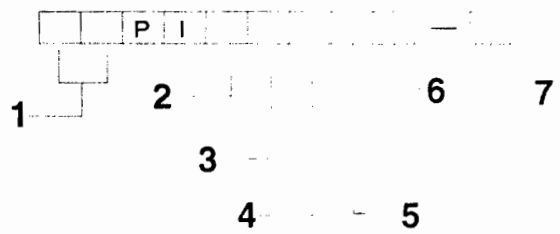
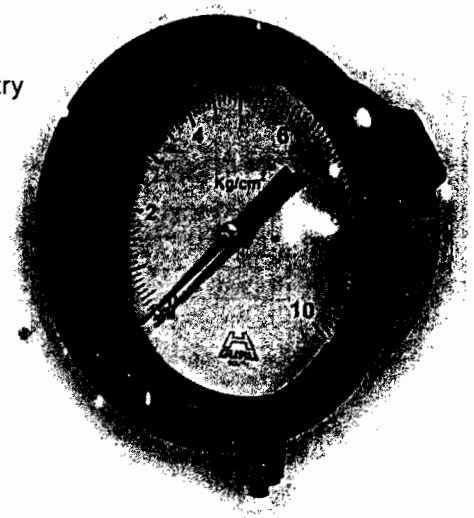


Table PGI-8: Ordering Procedure (Mini Range)

1	2	3	4	5	6	7
Dial Size	**Element Mat**	**Movement**	**Conn. Mat**	**Case**	**Entry-Mounting**	**Accessories**
02=50mm	S=SS316	S=SS304	S=SS316	A=Al Alloy	1= Bottom - Surface	Please Refer
03=63mm	M=Monel	N=Brass	M=Monel	S=SS	2= Bottom - Direct	Accessory Section
					5= Back - Flush Panel	
					6= Back - Direct	

Solid Front Industrial Pressure Gauge:



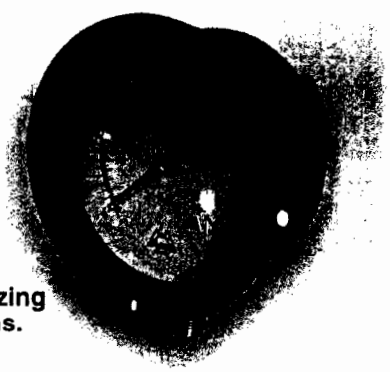
Solid Front Pressure Gauges are high safety gauges used in process industry applications. These essentially have a shield behind the window of the gauge to prevent any shock created within the gauge from shattering the window. These gauges also incorporate a safety back with blow out discs to vent the pressure through the back, in the event of an internal failure. These gauges are ideally suited for applications where the risk of explosion of the pressure system is existent.

Additional Technical Specifications:
Dial Sizes: 150mm
Accuracy (10~90% of scale): +/- 1% FSD
Casing Options: Cast Aluminum LM6 Alloy (Refer Table PGI-3 for details)
*All Other Specifications as in Standard Range.

Optional Extras:
- Drag Pointer**
- Cleaning for Oxygen, Acetylene, or other special services.
- Special Ranges & Scales : PSI, MPa, KPa etc.
- Custom made Dials with special markings.
- Applicable Accessories

*Computer Code Construction as in Standard Range.

Liquid Filled Pressure Gauges:



Liquid filled gauges are used in applications which involve high mechanical vibration and pulsating pressure. The sensing element, movement and pointer are kept immersed in a liquid which dampens their motion and lengthens their life. These instruments are designed for use on power units, pumps, hydro cleaning machines, compressors, turbines, diesel engines, chemical lines and refrigerating plants and machines and equipment.

***Caution: To avoid possibility of explosion, gauges with glycerine filling should not be used to measure O_2, Cl, HNO_3, H_2O_2, NH_3 and other strong oxidizing agents. The use of fluronate fluid filling is recommended for such applications.**

Technical Specifications:
Dial Sizes: 63mm, 100mm, 150mm
Accuracy (10~90% of scale): +/- 1% FSD, +/-1.5% FSD (DS 63mm)
Standard Ranges: Refer Table PGI-1
Working Pressure: 10 ~ 70% of Scale (Steady Pressure)
10 ~ 50% of Scale (Fluctuating Pressure)
Over Pressure Protection: (Short Duration Only)
30% of scale up to 60Kg/cm² ; 25% of scale up to 100Kg/cm² ; 15% of scale above 100Kg/cm²
Operating Temperature: -29 C ~ 65 C (Glycerine filling), -29 C ~ 150 C (for Silicone filling)
Sensing Element: Bourdon Tube
Weather Protections: IP55, IP65.
Mounting Options: Refer Table PG -4
Approximate Weight: Refer Table PGI-5
***All Other Specifications As In Standard Range**
***Electric Contacts Are Not Applicable**

Accessory Codes For Liquid Filling:
(Please mention this code in place provided for accessory code)
- **Glycerine Filling: GF**
- **Silicone Filling: SF**
- **Fluronate Filling: FF**

Table PGI-1 : Standard Ranges

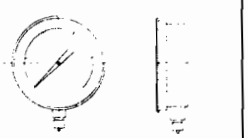
Kg/cm²	Bar	mm Hg
0 ~ 0.6	0 ~ 0.6	-
0 ~ 1	0 ~ 1	-
0 ~ 1.6	0 ~ 1.6	-
0 ~ 2.5	0 ~ 2.5	-
0 ~ 4	0 ~ 4	-
0 ~ 6	0 ~ 6	-
0 ~ 7	0 ~ 7	-
0 ~ 10	0 ~ 10	-
0 ~ 16	0 ~ 16	-
0 ~ 21	0 ~ 21	-
0 ~ 25	0 ~ 25	-
0 ~ 40	0 ~ 40	-
0 ~ 60	0 ~ 60	-
0 ~ 100	0 ~ 100	-
0 ~ 160	0 ~ 160	-
0 ~ 250	0 ~ 250	-
0 ~ 400	0 ~ 400	-
0 ~ 600	0 ~ 600	-
0 ~ 1000	0 ~ 1000	-
-1 ~ 0	-1 ~ 0	-760 ~ 0
-1 ~ 0.6	-1 ~ 0.6	-
-1 ~ 1	-1 ~ 1	-
-1 ~ 1.5	-1 ~ 1.5	-
-1 ~ 3	-1 ~ 3	-
-1 ~ 5	-1 ~ 5	-
-1 ~ 6	-1 ~ 6	-
-1 ~ 9	-1 ~ 9	-
-1 ~ 15	-1 ~ 15	-

*Applicable For Mini Range Also

Table PGI-2: Standard Process Connections

Dial Size	50mm	63mm	100mm	150mm	200mm	250mm	300mm
Connection							
1/2"NPTM	-	-	*	*	*	*	*
1/2"BSPM	-	-	*	*	*	*	*
M20*1.5 M	-	-	*	*	*	*	*
M18*1.5 M	-	-	*	*	*	*	*
3/8"NPTM	-	-	*	*	*	*	*
3/8"BSPM	-	-	*	*	*	*	*
3/8"NPTF	-	-	*	*	*	*	*
3/8"BSPF	-	-	*	*	*	*	*
1/4"NPTM	*	*	*	*	*	*	*
1/4"BSPM	*	*	*	*	*	*	*
1/4"NPTF	-	-	*	*	*	*	*
1/4"BSPF	-	-	*	*	*	*	*
1/8"NPTM	*	*	*	*	*	*	*
1/8"BSPM	*	*	*	*	*	*	*
1/8"NPTF	-	-	*	*	*	*	*
1/8"BSPF	-	-	*	*	*	*	*

Bottom Entry - Direct Mounting



Applicable Dial Sizes

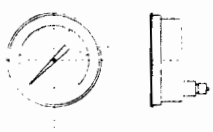
50	63	100	150	200	250	300

Back Entry - Panel Mounting

Applicable Dial Sizes

63	100	150	200

Back Entry - Direct Mounting



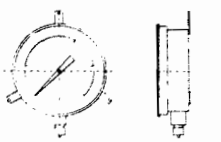
Applicable Dial Sizes

50	63	100	150	200	250	300

Table PGI-3: Case Dimensions - Case Size / Material

Material	Cast Aluminum LM6		Stainless Steel	
	Enamel	Epoxy	SS1	SS2
Dial Size				
50mm	-	-	*	-
63mm	*	*	*	-
100mm	*	*	*	*
150mm	*	*	*	*
200mm	*	*	-	-
250mm	*	*	-	-
300mm	*	*	-	-

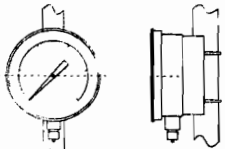
Bottom Entry - Surface Mounting



Applicable Dial Sizes

50	63	100	150	200	250	300

Bottom Entry - Pipe Mounting



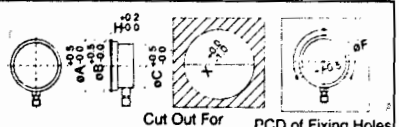
Applicable Dial Sizes

100	150	200	250	300

Table PGI-4 - Induatrial Pressure Gauges Mounting Options

Table PGI-3

Cast Al LM6 Alloy Case



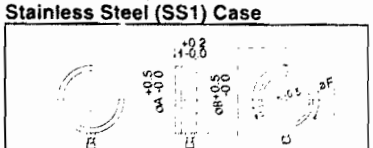
Cut Out For Panel Mounting

PCD of Fixing Holes (Surface Mounting)

DIAL SIZE	A	B	C	H	X	F
63	78.5	75	67.5	41.5	76	98
100	128.5	120.5	106.5	50.5	122.5	141.5
150	178.5	170.5	157.5	59.5	172.5	191.5
200	226.5	217.5	204.5	60	218.5	238
250	282.5	274.5	259.5	60.5	276.5	291.5
300	332.5	324.5	310.0	60.5	276.5	342

All Dimensions are in mm

Stainless Steel (SS1) Case

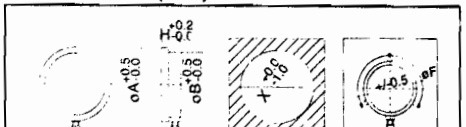


PCD of Fixing Holes For Surface Mounting

DIAL SIZE	A	B	H	F
50	52	51.5	31	63
63	66.0	64.0	29.0	75
100	97.0	96.5	47.0	134.5
150	154.0	152.0	49.0	190

All Dimensions are in mm

Stainless Steel (SS2) Case



Cut Out For Panel Mounting

PCD of Fixing Holes For Surface Mounting

DIAL SIZE	A	B	H	X	F
100	116.0	99.5	47.5	101	137
150	174.0	153.0	51	154.5	190.5

All Dimensions are in mm

Table PGI-5: Approxmiate Weight:

Dial Sizes	Case Types							
	Al Alloy		SS1		SS2		Phenolic	
	Dry	Liquid Fill	Dry	Liquid Fill	Dry	Liquid Fill	Dry	Liquid Fill
50mm	-	-	0.145 Kg	0.18 Kg	-	-	-	-
63mm	0.25 Kg	0.33 Kg	0.175 Kg	0.25 Kg	-	-	-	-
100mm	0.6 Kg	1 Kg	0.5 Kg	-	0.52 Kg	0.9 Kg	-	-
150mm	1 Kg	1.8 Kg	0.8 Kg	-	0.96 Kg	1.75 Kg	0.75 Kg	-
200mm	1.6 Kg	-	-	-	-	-	-	-
250mm	2.4 Kg	-	-	-	-	-	-	-
300mm	3 Kg	-	-	-	-	-	-	-

Corrosion Chart:

To use the chart below, locate the fluid whose pressure is to be measured and select a material, from the compatible materials, which are indicated by a dot. The general assumption is that the process fluid is at a temperature below 80 C except where specified. However, final selection of material is recommended to be made only after verifying the same with qualified personnel.

* Below 38°C / 100°F

❶ Over 70 Bar — entire system must be 316 stainless steel.

❷ Monel, Bronze and 316 stainless steel and acceptable for oxygen service, provided the instrument has been cleaned for oxygen service and is free from oil.

Media Application	Pressure Instrument Material				
	Brass or Bronze	AISI SS304	AISI SS316	Monel	Chemical Seals**
Acetone*	•	•	•	•	
Acetic Acid <40%			•		
Acetic Anhydride					•
Acetylene (Dry)		•	•		
Acrolein 100%					•
Air	•	•	•	•	
Alcohol, Ethyl	•	•	•	•	
Alum. Chloride > 10%					•
Alum. Sulfate 10~50%					•
Ammonia Gas (Dry)		•	•		
Ammonium Choride <40%					•
Ammonium Nitrate <50%			•		
Ammonium Sulfate <60%					•
Aniline>99%			•		
Argon	•	•	•	•	
Beer		•	•		
Benzidine >99%					•
Benzene <50%			•	•	
Benzoic Acid <70%			•		•
Boric Acid <25%			•		
Bromine (Dry)					•
Butane	•	•	•	•	
Butyric Acid <10%			•		
Calcium Chloride <50%					•
Calcium Hydroxide <50%					•
Carbon Dioxide	•	•	•	•	
Carbon Monoxide >99%	•	•	•	•	
Chlorine (Dry)					•
Chlorine (Moist)*					•
Chloroform (Dry)			•	•	
Chromic Acid					•
Citric Acid 10-50%		•	•		
Corn Oil		•	•		

Media Application	Pressure Instrument Material				
	Brass or Bronze	AISI SS304	AISI SS316	Monel	Chemical Seals**
Crude Oil (Sour)				•	
Crude Oil (Sweet)			•	•	
Ethyl Acetate	•	•	•	•	
Ethylene Oxide >99%*	•	•	•	•	
Ferric Chloride <40%					•
Ferric Sulfate <10%*			•		
Ferrous Chloride <30%					•
Ferrous Sulfate <50%					•
Fluorine Gas (Dry)				•	
Formaldehyde <95%		•	•	•	
Formic Acid*					•
Freons		•	•		
Furfural <10%					•
Gasoline (Fleming)	•	•	•		
Glycerin >99%	•	•	•	•	
Hydrobromic Acid					•
Hydrochloric Acid					•
Hydrofluoric Acid					•
Hydrofluosilic Acid					•
Hydrogen ❶	•	•	•		
Hydrogen Peroxide <50%					•
Kerosene	•	•	•	•	
Lactic Acid <70%*			•		
Magnesium Chloride <40%					•
Mercury >99%		•	•		
Milk		•	•		
Naphtha >99%	•	•	•	•	
Naphthalene >99%		•	•		
Nickel Chloride >99%					•
Nitric Acid <95%*			•		
Nitrogen	•	•	•	•	
Oleic Acid	•	•	•		
Oxalic Acid*					•

Media Application	Pressure Instrument Material				
	Brass or Bronze	AISI SS304	AISI SS316	Monel	Chemical Seals**
Oxygen (Gas) ❷	•	•	•	•	
Palmitic Acid >99%*			•		
Phosphoric Acid <80%			•		
Picric Acid <10%			•		
Propane (Dry)		•	•	•	
Sea Water (Flowing)				•	
Silver Nitrate <70%					•
Sodium Bicarbonate <20%			•	•	
Sodium Bisulfate <30%					•
Sodium Carbonate <40%				•	
Sodium Chromate <60%	•	•	•	•	
Sodium Cyanide*		•	•		
Sodium Hydroxide <40%		•	•		
Sodium Hypochlorite <25%					•
Sodium Phosphate, Tri <60%		•	•	•	
Sodium Silicate <50%		•	•	•	
Sodium Sulfide <50%					•
Stannous Chloride <10%			•		
Steam (Use siphon)	•	•	•	•	
Stearic Acid			•	•	
Sulfur Dioxide (Dry) >99%					•
Sulfur Trioxide (Dry) >99%					•
Sulfuric Acid					•
Tannic Acid <80%	•	•	•	•	
Tartatic Acid <50%		•	•	•	
Tin Chloride (ous) <10%			•		
Toluene >99%	•	•	•	•	
Turpentine >98%	•	•	•	•	
Water (Tap)	•	•	•	•	
Whiskey		•	•		
Zinc Chloride <25%*					•
Zinc Sulphate <40%					•

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- Industrial Pressure Gauges
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- Precision Pressure Gauges
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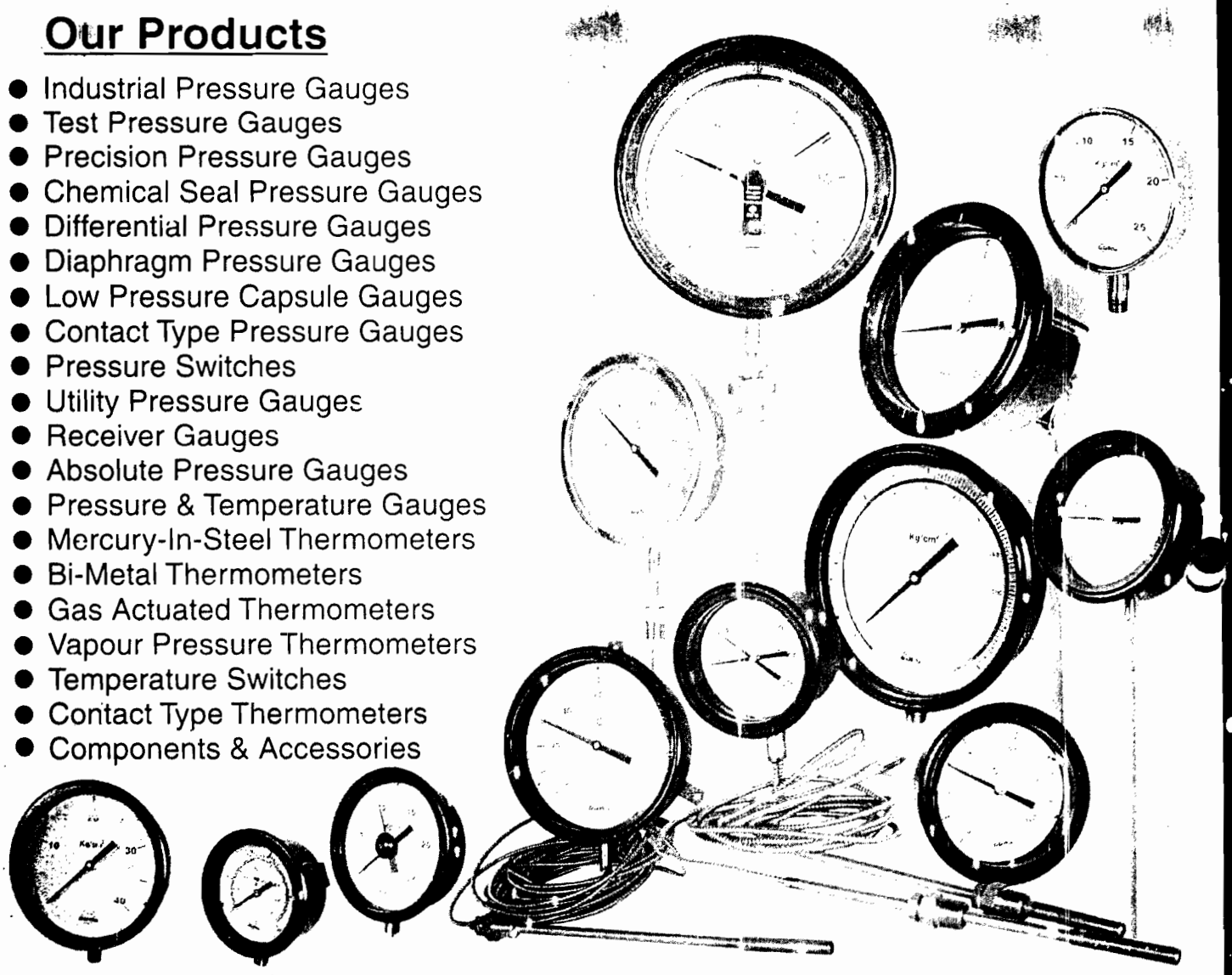
- Differential Pressure Gauges
- Diaphragm Pressure Gauges
- Low Pressure Capsule Gauges
- Contact Type Pressure Gauges
- Pressure Switches
- Utility Pressure Gauges
- Receiver Gauges
- Absolute Pressure Gauges
- Pressure & Temperature Gauges
- Mercury-In-Steel Thermometers
- Bi-Metal Thermometers
- Gas Actuated Thermometers
- Vapour Pressure Thermometers
- Temperature Switches
- Contact Type Thermometers
- Components & Accessories



* Due to continuous improvement, specifications mentioned, or products, may be altered or discontinued without prior notice.

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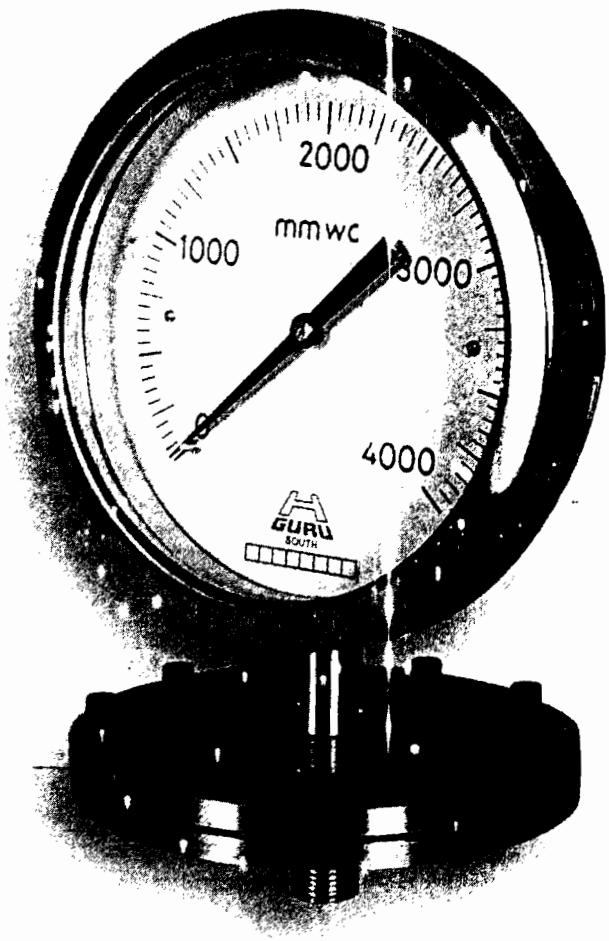
Diaphragm Pressure Gauges



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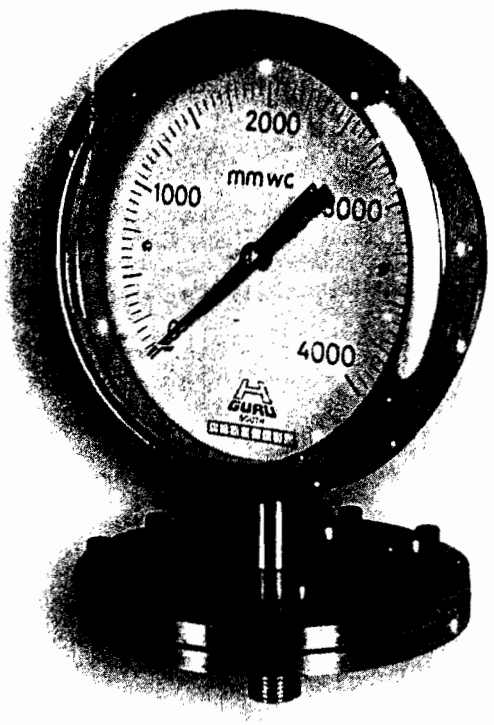
Diaphragm Pressure Gauges:

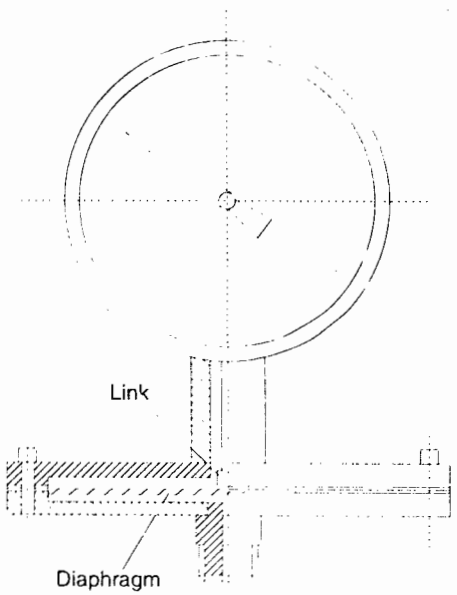
Diaphragm pressure gauges are used in the measurement of medium and relatively low pressures. The sensing element is a circular convoluted diaphragm made of steel. The application of pressure on this element results in its expansion, which makes the center of the element to displace linearly. This displacement is measured and used as an indicator of the pressure applied. The element can be provided with different material protection, to suit different applications. The process fluid is in full contact with the sensing element and thus there is little chance of choking of the pressure element. These gauges are available in various assemblies to suite various applications. These gauges are suitable for applications where:

1. Measurement of relatively low pressure is required. Ex. Air purge systems, etc.
2. The pressure medium would clog the pressure element. Ex. Slurry, viscous fluids, etc.
3. The pressure medium is corrosive to the sensing element. Ex. Acids, corrosive chemicals, etc.
4. The pressure medium has a tendency to coagulate on stagnation. Ex. Paints, etc.
5. High over pressure protection is desired. Ex. Applications where low pressure cycles alternate with high pressure cycles.
6. Vacuum pumps where the starting vacuum is high, but the working vacuum is low, etc.

*The above applications may require different element protection, assemblies and special features.

Standard Type:





Diaphragm Pressure Gauge

These are suitable for general industrial use. These are used for medium and low pressure measurement.

Ordering Procedure: Computer Code Construction (See Table SDG-5 for details)
*Please indicate additional specifications separately.

D P / –
1 2 7 8
3 6
4 5

Table SDG-5: Ordering Procedure

1	2	3	4	5	6	7	8
Dial Size	**Element Mat**	**Movement**	**Conn. Mat**	**Case**	**Entry-Mounting**	**Type**	**Accessories**
04=100mm	S=Steel	S=SS304	S=SS316	A=Al Alloy	1= Bottom - Surface	1=Standard Type	Please Refer
06=150mm	E=Teflon Lining	N= Brass		S=SS	2= Bottom - Direct	2=Standard Flange Type	Accessory Section
	I=Silver Coating				7=Bottom - Pipe	3=Standard Flushing Type	
						4=Over Pressure Type	
						5=Full Vacuum Type	
						6=Over Pressure Flange Type	
						7=Over Pressure Flushing Type	

Table SDG-1: Standard Ranges

Low Range	
mmWC	mBar
0 ~ 400	0 ~ 40
0 ~ 600	0 ~ 60
0 ~ 1000	0 ~ 100
0 ~ 1600	0 ~ 160
0 ~ 2500	0 ~ 250
0 ~ 4000	0 ~ 400
0 ~ 6000	0 ~ 600
-200 ~ 200	-20 ~ 20
-300 ~ 300	-30 ~ 30
-500 ~ 500	-50 ~ 50
-600 ~ 1000	-60 ~ 100
-1000~ 1500	-100 ~ 150
-2000 ~2000	-200 ~ 200

High Range		
Range	Kg/cm	Bar
0 ~ 1	*	*
0 ~ 1.6	*	*
0 ~ 2.5	*	*
0 ~ 4	*	*
0 ~ 6	*	*
0 ~ 7	*	*
0 ~ 10	*	*
0 ~ 16	*	*
0 ~ 21	*	*
0 ~ 25	*	*
-1 ~ 0	*	*
-1 ~ 0.6	*	*
-1 ~ 1	*	*
-1 ~ 1.5	*	*
-1 ~ 3	*	*
-1 ~ 5	*	*
-1 ~ 9	*	*
-1 ~ 15	*	*
-1 ~ 20	*	*

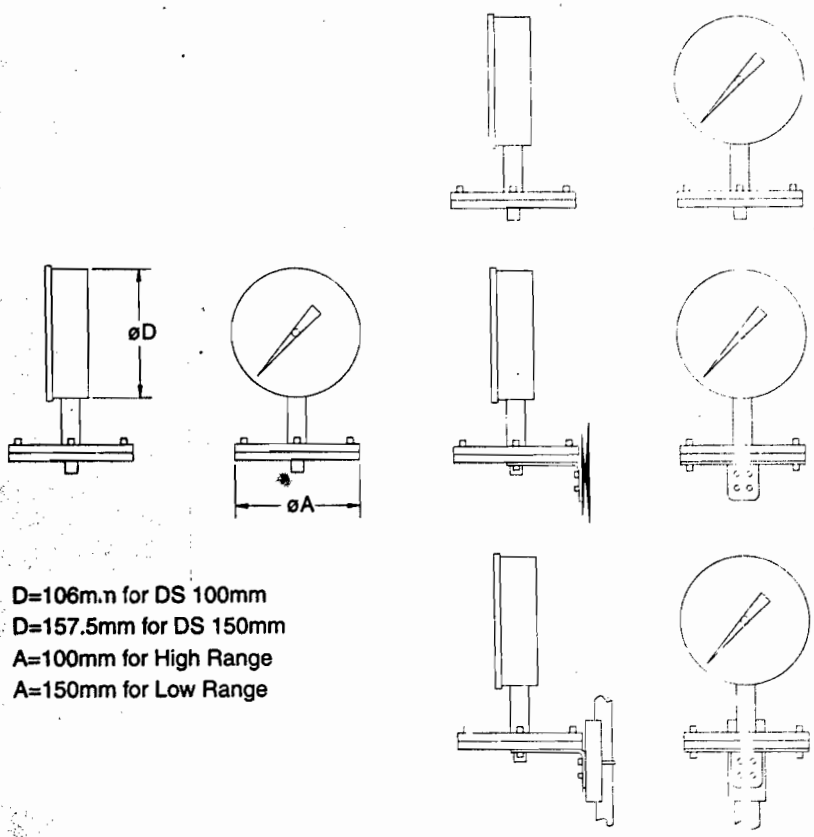
Table SDG-2:
Standard Process Connections

Dial Size	100mm	150mm
Connection		
1"NPTM	*	*
1"BSPM	*	*
1/2"NPTM	*	*
1/2"BSPM	*	*
M33*2 M	*	*
M20*1.5 M	*	*
M18*1.5 M	*	*
3/8"NPTM	*	*
3/8"BSPM	*	*
3/8"NPTF	*	*
3/8"BSPF	*	*
1/4"NPTM	*	*
1/4"BSPM	*	*
1/4"NPTF	*	*
1/4"BSPF	*	*
1/8"NPTM	*	*
1/8"BSPM	*	*
1/8"NPTF	*	*
1/8"BSPF	*	*

Table SDG-4: Approxmiate Weight:

Weight In Kg Dial Sizes	Low Range	High Range
100mm	2.1	1.2
150mm	2.5	1.6

Table SDG-3: Mounting Options



Bottom Entry - Direct Mounting

Bottom Entry - Surface Mounting

Bottom Entry - Pipe Mounting

D=106mm for DS 100mm
D=157.5mm for DS 150mm
A=100mm for High Range
A=150mm for Low Range

Table SDG-6: High Over Pressure Type

Ranges	
mmWC	mBar
0 ~ 250	0 ~ 25
0 ~ 400	0 ~ 40
0 ~ 600	0 ~ 60
0 ~ 1000	0 ~ 100
0 ~ 1600	0 ~ 160
0 ~ 2500	0 ~ 250
0 ~ 4000	0 ~ 400
-200 ~ 200	-20 ~ 20
-300 ~ 300	-30 ~ 30
-500 ~ 500	-50 ~ 50
-600 ~ 1000	-60 ~ 100
-1000~ 1500	-100 ~ 150
-2000 ~2000	-200 ~ 200

Table SDG-7: Full Vacuum Safe Type

Ranges		
mmWC	mBar	mmHg
-250 ~ 0	-25 ~ 0	-18 ~ 0
-400 ~ 0	-40 ~ 0	-30 ~ 0
-600 ~ 0	-60 ~ 0	-45 ~ 0
-1000 ~ 0	-100 ~ 0	-75 ~ 0
-1600 ~ 0	-160 ~ 0	-120 ~ 0
-2500 ~ 0	-250 ~ 0	-185 ~ 0
-4000 ~ 0	-400 ~ 0	-300 ~ 0

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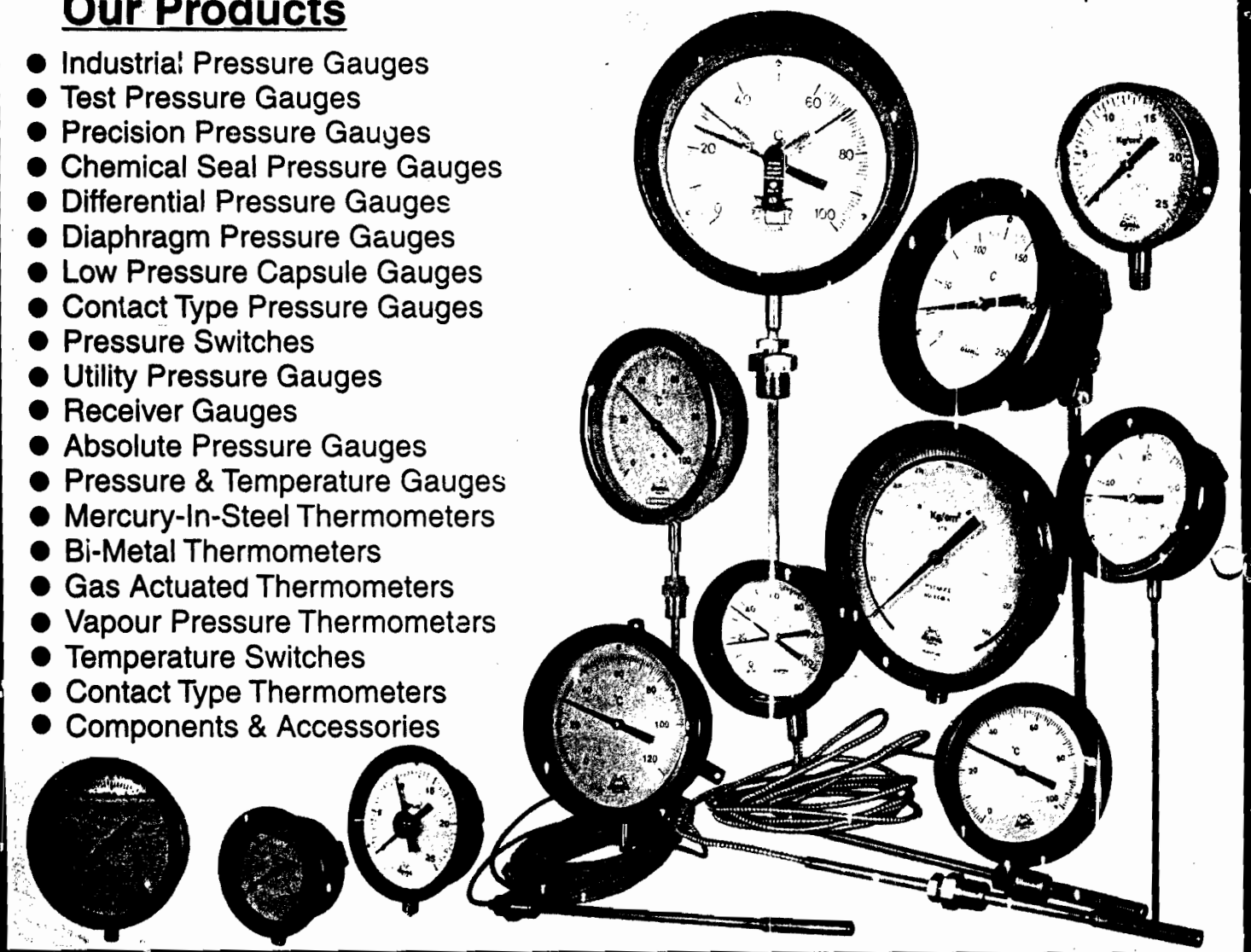

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GURU SOUTH

C.E./THERMAL DESIGNE, PSEB, PATIALA

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1. Copies of final distribution.
2. Approved.
3. Approved except as noted. Forward final drgs. (Proceed for manufacture/construction parallely.)
4. Approved except as noted rectification. Resubmission is required.
5. Not approved. See accompanying letter.
6. For information and record only.

Refer Memo No. MD-III/772/5586/87 Date 31-3-06

Approval of the Supplier's drawings by the purchaser does not relieve the Supplier or any part of supplier's obligation to meet all the requirements of the specification, Purchase Order or of the responsibility for the correctness of the supplier's drawings or documents.

CHECKED	RECOMMENDED	APPROVED
		Date 16/03/06
AD/MD	DD/MD	DIR/MECH.

C.E./THERMAL DESIGNE, PSEB, PATIALA

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CHECKED	RECOMMENDED	APPROVED
AD/MD	DD/MD	DIR/MECH.

OWNER:	PUNJAB STATE ELECTRICITY BOARD PATIALA
PROJECT:	2 X 250MW GHTP LEHRA MOHABBAT THERMAL POWER PROJECT STAGE – II, UNITS 3 & 4
OWNER'S CONSULTANT:	TCE CONSULTING ENGINEERS LIMITED BANGALORE
CONTRACTOR:	BHARAT HEAVY ELECTRICALS LTD. POWER SECTOR PROJECT ENGINEERING MANAGEMENT- NEW DELHI
ENGINEERING SUB CONTRACTOR:-	FICHTNER CONSULTING ENGINEERS(INDIA) PVT. LTD. CHENNAI.
VENDOR	BABUBHAI NAROTTAMDAS & CO. 'BANACO HOUSE' P-1, CAMA INDUSTRIAL ESTATE, WALBHAT ROAD, GOREGAON (EAST), MUMBAI - 400063

Prepared by	Checked by	Approved by	TITLE: -
PBP	VKM	DRK	EVAPORATOR FOR CW SYSTEM

BHEL DOC NO. –	DOCUMENT NO. –	REV. -
PE-DC-226-174-A014	BNC/A/1115/DS/05 (SHEET 1 OF 5)	R1

13 MAR 2006

RECORD OF REVISIONS

Rev. No.	Date	Revision Details	Revised by	Approved by
R0	24/12/05	FOR APPROVAL		
R1	23/02/06	Revised as per Fichtner Comments		

TECHNICAL DATA SHEET

BANACO BABUBHAI NAROTAMDAS & CO. BANACO House, P-1 Cama Ind Estate, Walbhat Road, Goregaon (E), Mumbai - 400 063 Phone: 873 3048, 873 5386 Fax: 022-873 2182	DOC NO : BNC/A/1115/DS/05 REV NO : R1 DATE : 28/02/06 DESCRIPTION : EVAPORATOR For CW System
BHEL DOC NO :PE-DC-226-174-A014	SHEET NO. : 3 of 5
P&I DIAGRAM NO. : BNC/4472	

A	**EVAPORATOR**		
1.0	**Make**	:	BANACO.
2.0	**Quantity**	:	2 Nos (1W + 1S/b)
3.0	**Tag Nos**	:	EVAP-1 & EVAP-2
4.0	**Maximum Capacity**	:	216 Kg/hr.
5.0	**Type of Heat Exchanger**	:	Electrically Heated Immersion Water Bath Type.
6.0	**Heat Input Required/Unit**	:	18 Kw, 415V+/-10%,50Hz+/-5%, 3 Ph.
A1	**Immersion Heater**		
1.0	**Number /Unit**	:	1 No.
2.0	**Capacity**	:	18 Kw
3.0	**M.O.C. of Electrical heater**	:	SS 304 Coil Body MS IS:2062 Gr.B
A2	**Vaporising Chamber**		
1.0	**Size and Thickness**	:	200NB x 12.7 mm Thk (Sch 80) . SA106 Gr-B Seamless
2.0	**Design Code**	:	ASME Sect VIII Div 1.
3.0	**Fluid Handled**	:	Chlorine Gas/ Chlorine Liquid.
4.0	**Design Pressure**	:	38.3 Kgf/Sq.Cm (g) @ 100 Deg Cel.
5.0	**Operating Pressure**	:	10 Kgf/Sq. Cm(g)
6.0	**Operating Temperature**	:	45 Deg Cel.
7.0	**Hydro-Test Pressure**	:	60 Kgf/Sq.Cm (g)
8.0	**Radiography**	:	100% on all butt weld Joints
9.0	**Corrosion Allowance**	:	3.0 mm.

TECHNICAL DATA SHEET

BANACO BABUBHAI NAROTAMDAS & CO. BANACO House, P-1 Cama Ind Estate, Walbhat Road, Goregaon (E), Mumbai - 400 063 Phone: 873 3048, 873 5386 Fax: 022-873 2182	DOC NO REV NO DATE DESCRIPTION	: BNC/A/1115/DS/05 : R1 : 28/02/06 : EVAPORATOR For CW System
BHEL DOC NO :PE-DC-226-174-A014	SHEET NO.	: 4 of 5
P&I DIAGRAM NO.	: BNC/4472	

10.0	**Weight**	: 250 Kg
A3	**Water Chamber**	:
1.0	**Size and Thickness**	: 300NB x 5.5 Thk ERW pipe as per IS:3589 2001
2.0	**Insulation Material**	: Glass Wool Aluminium Sheet.
3.0	**Temperature of Water Bath**	: 80 Deg Cel.
4.0	**Max. Outside Surface Temp.**	: 45 Deg Cel.
5.0	**Fluid Handled**	: Water.
6.0	**Design Pressure**	: Atmospheric.
7.0	**Operating Pressure**	: Atmospheric.
8.0	**Hydro-Test Pressure**	: Water Fill Test. Please indicate hydro Test pressure.
9.0	**Joint Efficiency**	: 0.7.
10.0	**Radiography**	: Nil.
11.0	**Corrossion Allowance**	: 1.5 mm.
12.0	**Stress Relieving**	: NA.
13.0	**Colour Painted**	: Hot Dipped Galvanised to 80 microns
14.0	**Weight**	: 170 Kg
A4	**Make up Water**	
1.0	**Make up Water (for water bath)requirements/ evaporator.**	: 5000 cc/day.
2.0	**Capacity of make up water tank**	: 40 Ltrs.

TECHNICAL DATA SHEET

BANACO BABUBHAI NAROTAMDAS & CO. BANACO House, P-1 Cama Ind Estate, Walbhat Road, Goregaon (E), Mumbai - 400 063 Phone: 873 3048, 873 5386 Fax: 022-873 2182	DOC NO : BNC/A/1115/DS/05 REV NO . R1 DATE : 28/02/06 DESCRIPTION : EVAPORATOR For CW System
BHEL DOC NO :PE-DC-226-174-A014	SHEET NO. : 5 of 5

P&I DIAGRAM NO. : BNC/4472

A5 Cathodic Protection

Type of Cathodic Protection : Sacrifical Type Magnesium Anode rod 1Set/Unit with Ammeter in Control Panel

A6 Cabinet

1.0 **Overall Size/Unit** : 800 x 600wide x 1500 Ht

2.0 **Material** : FRP.

A7 Shipping Weight per Unit : 450 Kg

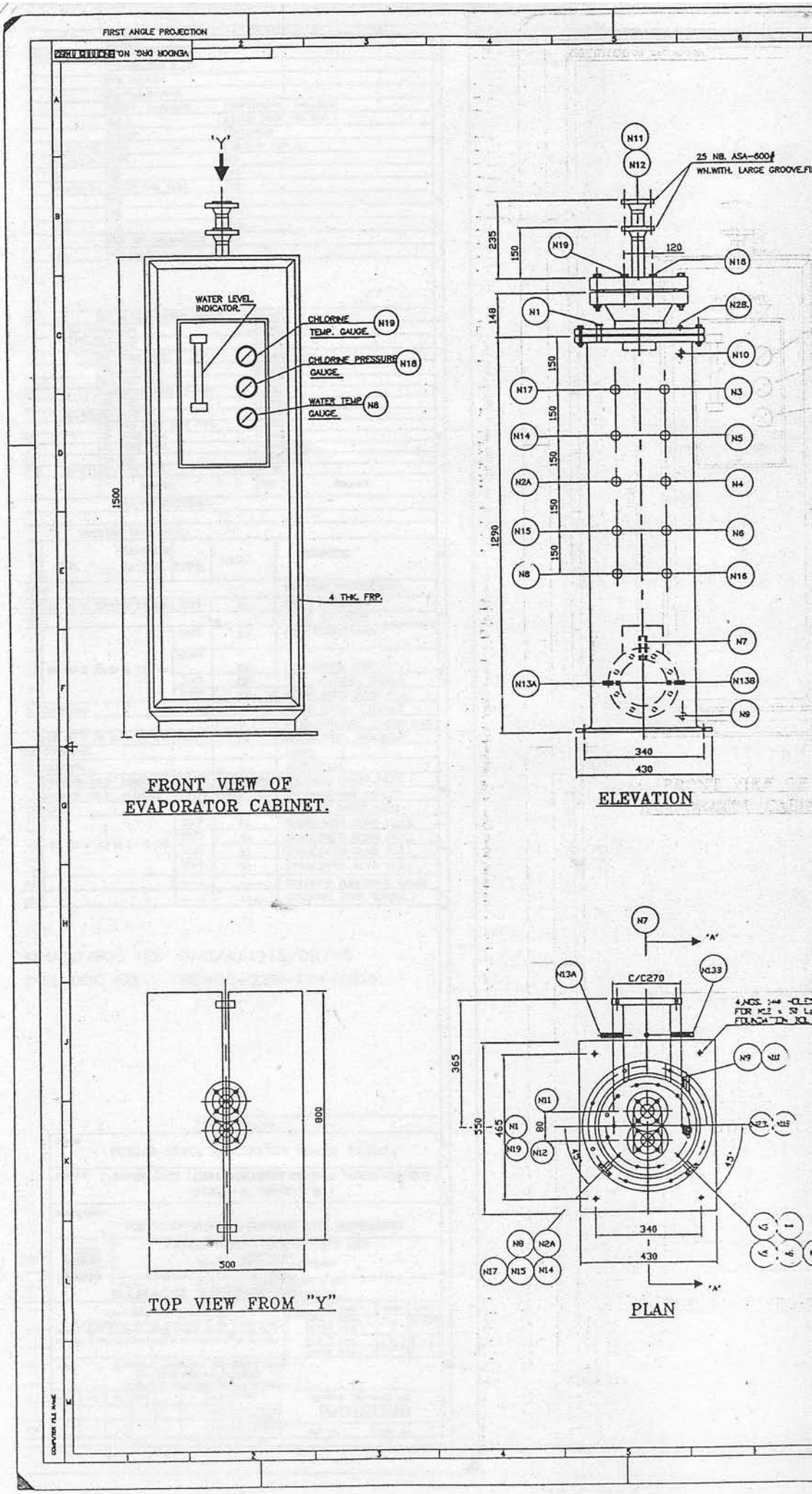
A8 Material of Construction

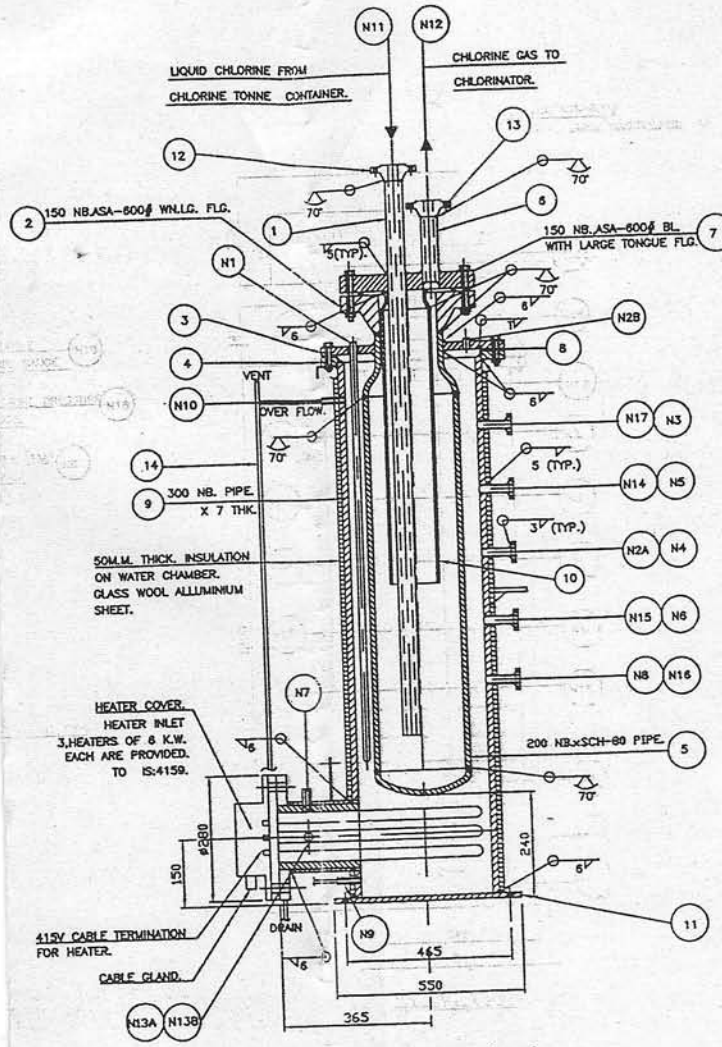
1.0	Liquid Chlorine Inlet Pipe	: SA 106 Gr-B, Seamless.
2.0	Bottom Flange (Inner Chamber)	: SA 105.
3.0	Counter Flange	: IS 2062 Gr-B.
4.0	Flange: Outer Chamber	: IS 2062 Gr-B.
5.0	Outer Chamber Pipe	: IS : 3589 2001 ERW Pipe
6.0	Gas Outlet Pipe	: SA 106 Gr-B, Seamless.
7.0	Top Flange (Inner Chamber)	: SA 105
8.0	Gasket	: Asbestos free gasket as per ISO 14001.
9.0	Inner Chamber Pipe	: SA 106 Gr-B.
10.00	Superheat Baffle Pipe	: SA 106 Gr-B.
11.00	Base Plate	: IS 2062 Gr-B.
12.00	Inlet Pipe Flange	: SA 105.
13.00	Outlet Pipe Flange	: SA 105.
14.00	Overflow & Drain piping	: MS IS:1239 Heavy(Galv).

A9 Tag Nos of Instrument Mounted on Evaporator

SL.No.	Description	Tag Nos
1.0	Level Indicator	LI-1, LI-2
2.0	Temperature Switch High	TS-3, TS-4
3.0	Temperature Switch Low	TS-1, TS-2
4.0	Temperature Control Switch	TCS-1, TCS-2
5.0	Level Switch Low	LS-1, LS-2
6.0	Water level Control Switch	WLC-1, WLC-2
7.0	Water Temperature Gauge	TI-3, TI-4
8.0	Chlorine Pressure Gauge	PI-3, PI-4
9.0	Chlorine Temperature Gauge	TI-5, TI-6
10.0	Cathodic Protection	Ammeter on control panel

A10 Reference Drawing & Data sheet for instruments : BNC/1115/1462 Rev.P0


FIRST ANGLE PROJECTION
VENDOR DRG. NO.
'Y'
WATER LEVEL INDICATOR.
CHLORINE TEMP. GAUGE.
N19
CHLORINE PRESSURE GAUGE.
N18
WATER TEMP GAUGE.
N8
1500
4 THK. FRP.
FRONT VIEW OF EVAPORATOR CABINET.
N11
N12
25 NB. ASA-600#
WN.WITH. LARGE GROOVE.FI
235
150
N19
120
N18
148
N1
N2B.
N10
150
N17
N3
150
N14
N5
150
N2A
N4
150
1290
N15
N6
150
N8
N16
N7
N13A
N13B
N9
340
430
ELEVATION
800
500
TOP VIEW FROM "Y"
N7
'A'
N13A
C/C270
N13B
365
550
465
N1
N19
N12
N11
80
N8
N2A
N17
N15
N14
340
430
'A'
PLAN



SECTION--A'-A'

MAKE	
NO OF EVAPORATORS TO BE SUP	
LOCATION	
MAX CAP. KG /HR.	
TAG NOS.	
CODE OF CONSTRUCTION	
FLUID HANDLED.	
DESIGN PRESSURE	
OPERATING PRESSURE	
OPERATING TEMPERATURE.	
HYDRO-TEST PRESSURE	
JOINT EFFICIENCY.	
RADIOGRAPHY.	
CORROSION ALLOWANCE.	
COLOUR PAINTED.	
WEIGHT.	

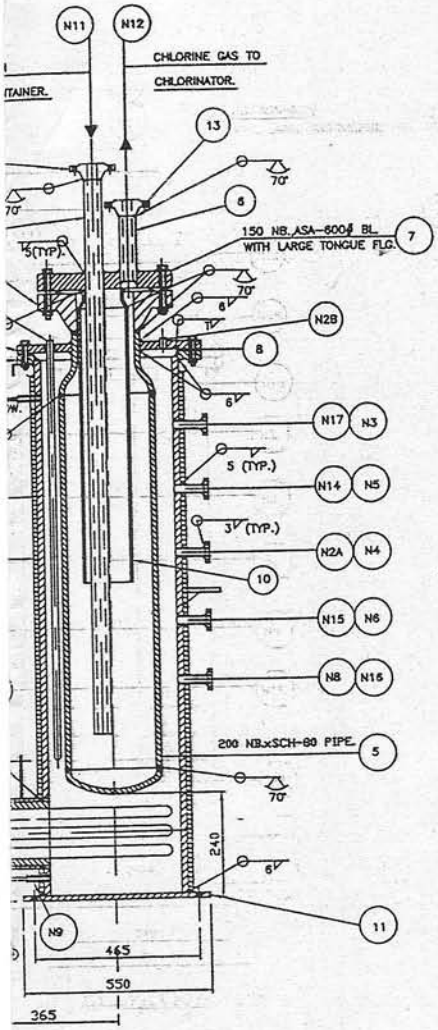
PART NOS	DESCRIPTION
14.	OVER FLOW & DRAIN PIP
13.	OUTLET PIPE FLANGE.
12.	INLET PIPE FLANGE.
11.	BASE PLATE
10.	SUPERHEAT BAFFLE PIPE.
9.	INNER CHAMBER PIPE.
8.	GASKET.
7.	FLANGE: INNER CHAMBER
6.	GAS OUTLET PIPE.
5.	OUTER CHAMBER PIPE.
4.	FLANGE: OUTER CHAMBE
3.	COUNTER FLANGE.
2.	FLANGE.(INNER CHAMBER
1.	LIQUID CHLORINE INLET F

NOZZLE MARK.	QTY	SIZE. NB.	SCH
N 1	1	3/4" B.S.P. T	
N 2A	1	20	CL-C
N 2B	1	3/8" B.S.P. T	
N 3	1	20	CL-C
N 4	1	20	CL-C
N 5	1	20	CL-C
N 6	1	20	CL-C
N 7	1	1" B.S.P. THR	
N 8	1	20	CL-C
N 9	1	1/2"B.S.P. THR	
N 10	1	1/2"B.S.P. THR	
N 11	1	25	80
N 12	1	25	80
N 13A/B	1+1	1 /2" B.S.P.C	
N 14	1	20	CL-C
N 15	1	20	CL-C
N 16	1	20	CL-C
N 17	1	20	CL-C
N 18	1	3/8" B.S.P. TH	
N 19	1	3/4" B.S.P. TH	

REFERENCE DOCUME

(1) DATA SHEET

JOB NO. : 225					
STATUS : CONTRACT					
DISCRIBUTION :					
TO No.OF					
AS PER FICHTNER COMMENTS DTD 23/1/06	V.K.P	R.K.P			
DETAILS	CHECKED	DRAWN	REV.		



SECTION--A'-A'

MAKE		BANACO	
NO OF EVAPORATORS TO BE SUPPLIED		2 NOS (1W+1S/B)	
LOCATION		CHLORINATION PLANT	
MAX CAP. KG /HR.		216 KG/HR	A
TAG NOS.		EVAP-1,EVAP-2,	
		WATER CHAMBER	VAPORISING CHAMBER
CODE OF CONSTRUCTION		G.E.P.	ASME SECT. VIII. DIV 1
FLUID HANDLED.		WATER	CHLORINE
DESIGN PRESSURE	KG./SQ.CM.	ATM.	38.3 @ 100° C
OPERATING PRESSURE	KG./SQ.CM.	ATM.	10
OPERATING TEMPERATURE.	°C	80	45
HYDRO-TEST PRESSURE	KG./SQ.CM.	WATER FILL TEST	80
JOINT EFFICIENCY.		0.7	1.0 B
RADIOGRAPHY.		NIL	FULL
CORROSION ALLOWANCE.	M.M.	1.5	3.0
COLOUR PAINTED.		HOT DIP GALVANISED	NO
WEIGHT.	Kgs.	450 Approx.	

BILL OF MATERIAL

PART NOS	DESCRIPTION		MATERIAL	QTY	REMARKS
14.	OVER FLOW & DRAIN PIPE		MS IS:1239 HEAVY (GALV)	1 NO.	
13.	OUTLET PIPE FLANGE.	(N-12)	SA-105	1 NO.	
12.	INLET PIPE FLANGE.	(N-11)	SA-105	1 NO.	
11.	BASE PLATE		IS; 2062 Gr.B.	1 NO.	
10.	SUPERHEAT BAFFLE PIPE.		SA. 106 Gr.B.	1 NO.	
9.	INNER CHAMBER PIPE.		SA. 106 Gr.B.	1 NO.	
8.	GASKET.		ASBESTOS FREE GASKET	1 NO.	
7.	FLANGE: (INNER CHAMBER.)		SA. 105.	1 NO.	
6.	GAS OUTLET PIPE.	(N-12)	SA. 106 Gr.B.	1 NO.	
5.	OUTER CHAMBER PIPE.		IS:3589 2001 ERW PIPE	1 NO.	
4.	FLANGE: OUTER CHAMBER.		IS; 2062 Gr.B.	1 NO.	
3.	COUNTER FLANGE.		IS; 2062 Gr.B.	1 NO.	
2.	FLANGE (INNER CHAMBER.)		SA.105.	1 NO.	
1.	LIQUID CHLORINE INLET PIPE.	(N-11)	SA. 106 Gr.B.	1 NO.	

NOZZLE SCHEDULE.

NOZZLE MARK.	QTY	SIZE. NB.	SCH	FLANGES: STD.	RATING.	TYPE.	PROJ.	SERVICE.
N 1	1	3/4" B.S.P. THRD.						CATHODIC PROTECTION .
N 2A	1	20	CL-C	98 OD X 30 ID X 12 THK		SOFF	50	LEVEL INDICATOR.
N 2B	1	3/8" B.S.P. THRD.						LEVEL INDICATOR.
N 3	1	20	CL-C			SOFF	50	TEMP SWITCH HIGH.
N 4	1	20	CL-C	98 OD X 30 ID X 12 THK		SOFF	50	TEMP.SWITCH LOW .
N 5	1	20	CL-C			SOFF	50	TEMP. CONTROL SWITCH.
N 6	1	20	CL-C			SOFF	50	SPARE (WITH BLIND FLG)
N 7	1	1" B.S.P. THRD. COUPLING.					-	WATER LEVEL CONTROL -
							-	& WATER LEVEL SWITCH LOW.
N 8	1	20	CL-C	98 OD X 30 ID X 12 THK		SOFF	50	WATER TEMP. INDICATOR.
N 9	1	1/2"B.S.P. THRD. COUPLING.					-	DRAIN.
N 10	1	1/2"B.S.P. THRD. COUPLING					-	OVER FLOW.
N 11	1	25	80	ANSI-B-16.5 ASA600#		WN.L.G.	Refer. DRG.	CHLORINE LIQUID INLET.
N 12	1	25	80	ANSI-B-16.5 ASA600#		WN.L.G.	Refer. DRG.	CHLORINE GAS OUTLET.
N 13A/B	1+1	1 /2" B.S.P.COUPLING.					-	MAKE UP WATER INLET.
N 14	1	20	CL-C	-		SOFF	50	SPARE (WITH BLIND FLG.)
N 15	1	20	CL-C	98 OD X 30 ID X 12 THK		SOFF	50	SPARE (WITH BLIND FLG.)
N 16	1	20	CL-C			SOFF	50	SPARE (WITH BLIND FLG.)
N 17	1	20	CL-C			SOFF	50	SPARE (WITH BLIND FLG.)
N 18	1	3/8" B.S.P. THRD.				----	---	CHLORINE PRESSURE GAUGE.
N 19	1	3/4" B.S.P. THRD.				----	---	CHLORINE TEMP. GAUGE.

REFERENCE DOCUMENT

(1) DATA SHEET BANACO DOC NO: BNC/A/1115/DS/05

BHEL DOC NO: PE-DC-226-174-A014

BHEL DWG. NO.

OWNER: PUNJAB STATE ELECTRICITY BOARD, PATIALA

PROJECT: 2x250MW GHTP LEHRA MOHABBAT THERMAL POWER PROJECT STAGE-II, UNITS 3 & 4

CONSULTANTS: TCE CONSULTING ENGINEERS LTD. BANGALORE

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI

VENDOR: BANACO — BABUBHAI NAROTTAMDAS & CO.

JOB NO. : 225
STATUS : CONTRACT
DISCRIBUTION :
TO No.OF

DEPT CODE		NAME	SIGN.	DATE
	DRN	SHITAL		5/12/05
	DESN	V.K.M		
	CHD	D.R.K		
	APPD	R.B.K		

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TITLE:- GENERAL ASSEMBLY OF EVAPORATOR AND EVAPORATOR CABINET (FOR C.W CHLORINATION SYSTEM)

VENDOR DRAWING NO. BNC/1115/1482

DETAILS	CHECKED	DRAWN	REV.	DATE
AS PER FICHTNER COMMENTS DTD 23/1/06	V.K.P	R.K.P		

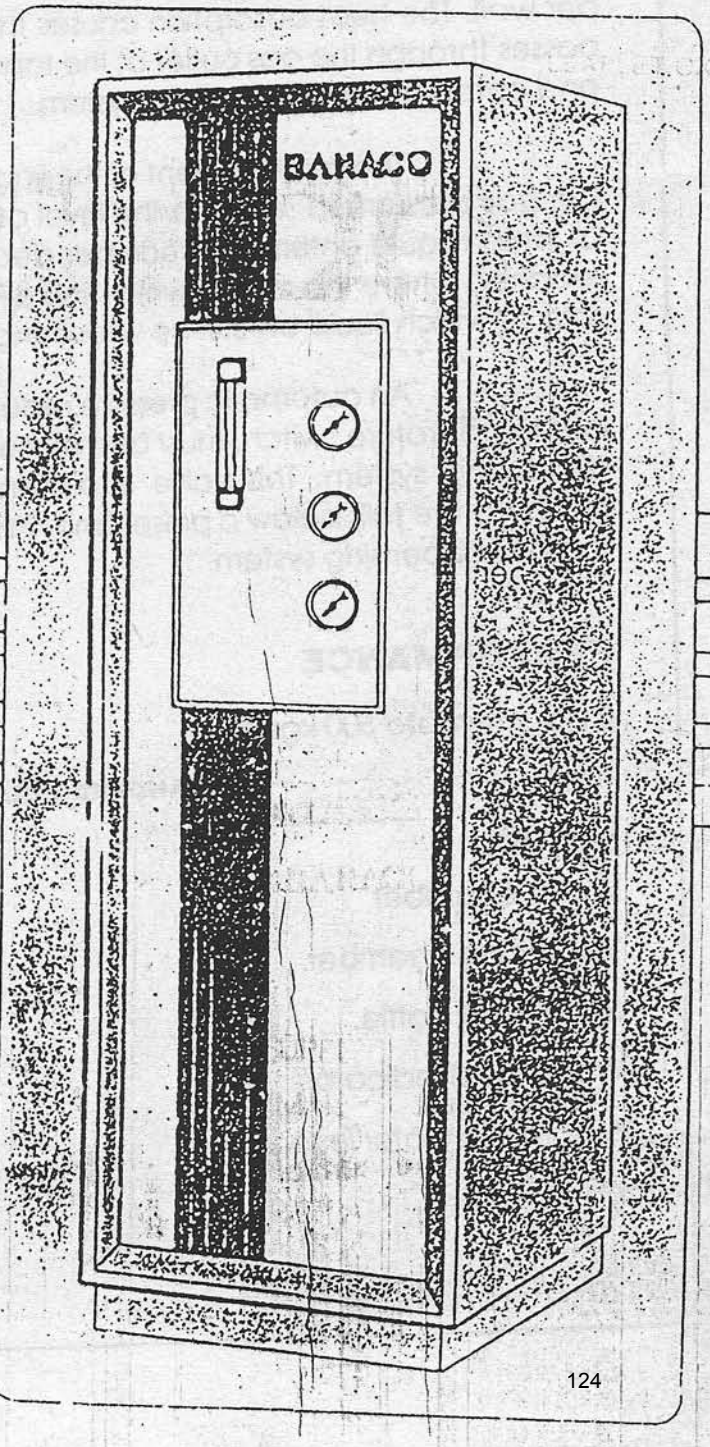
CV | WE | EL | I&C | DEPT. | SIGN | DATE | SCALE | SHT. No. 1 | REV. R1

BANACO

Vaporizer

75

ELECTRICALLY OR
STEAM HEATED



Series
75/1100/E
75/1101/E
75/1102/E

The electrically heated vaporizer evaporates liquid chlorine, sulfur dioxide or ammonia upon system demand. The unit has adequate controls and safety functions for fully automatic operation.

OPERATIONAL FEATURES

Liquid chlorine, sulfur dioxide or ammonia enters the vaporizer through the liquid inlet tube which is piped down into the vaporizing chamber. The vaporizing chamber is immersed in a water bath. The water is heated by an electric immersion heater thermostatically controlled to maintain constant temperature. The water level is automatically controlled through a level switch and a solenoid value combination.

The liquid absorbs heat from the water bath through the vaporizing chamber wall. The heat absorption causes the liquid to boil, converting it into gas. The gas passes through the gas outlet at the top of the vaporizing chamber after superheating and enters the gas dispensing system.

The arrangement of the liquid inlet tube and the gas outlet piping permits the gas pressure to regulate the level of the liquid. As the pressure increases, the rate at which liquid enters the chamber decreases. Eventually an equilibrium condition is reached where the rate at which liquid is being converted into gas exactly equals the rate at which liquid enters the vaporizing chambers.

An automatic pressure reducing and shut-off valve, controlled by a water low temperature switch, must be installed close to the vaporizer in the gas line to the dispensing system. This valve is automatically shut off when the water chamber temperature falls below a preset limit. This prevents liquid from entering and destroying the gas dispensing system.

PERFORMANCE

Capacity upto 600 kgs/hr.

STANDARD EQUIPMENT (ELECTRIC)

Cabinet

Water chamber

Vaporizing chamber.

Superheat baffle.

Water level indicator.

Automatic water level control

Gas pressure gauge

Gas temperature indicator

Water temperature controller

Min: water temperature switch

Max. water temperature switch

Immersion heater

MATERIALS OF CONSTRUCTION

CABINET

Fiberglass reinforced polyester.

WATER CHAMBER

Steel Boiler quality plate, heavily galvanised.

VAPORIZING CHAMBER

Steel-approved quality

OPTIONAL

Cathodic protection in water chamber

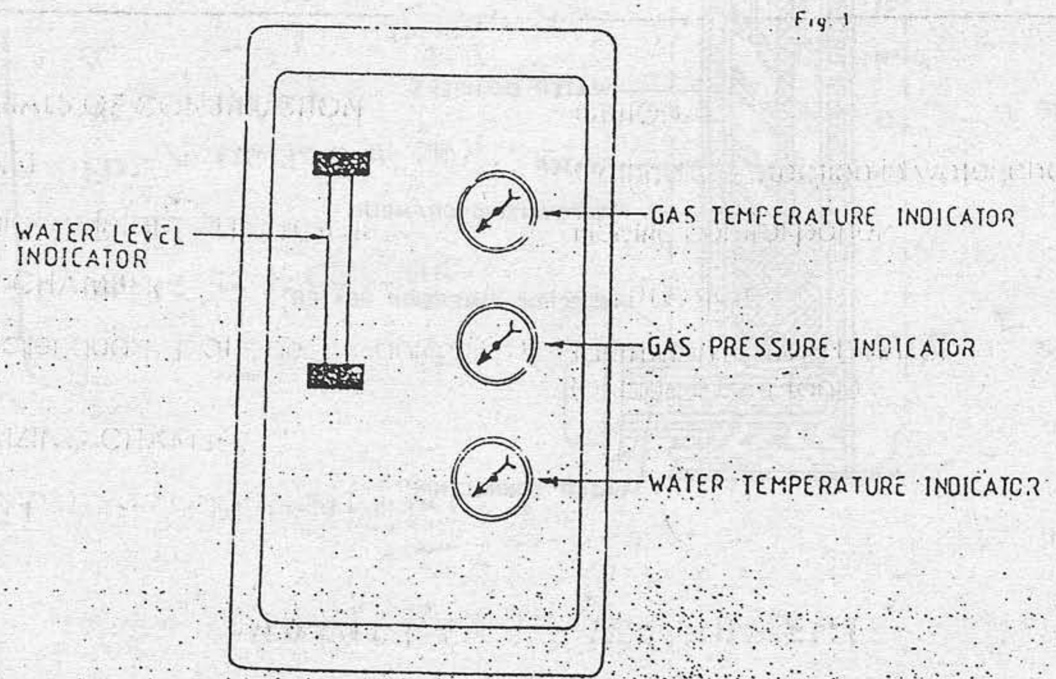
Electric control panel

Alarm system

Thermal insulating blanket (outside water tank)

CABINET-PANEL INSTRUMENT

Fig. 1

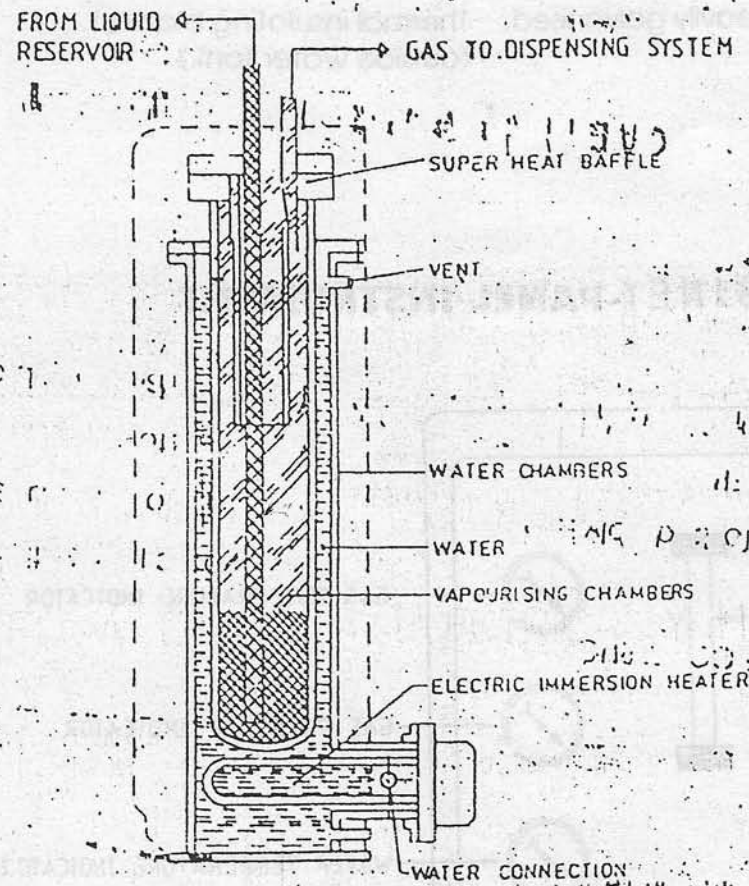


NOTE : STEAM HEATING

'BANACO' EVAPORATORS CAN ALSO BE MANUFACTURED AND SUPPLIED FOR HEATING BY STEAM IF REQUIRED. IN THIS CASE, INSTEAD OF ELECTRIC IMMERSIONS HEATERS. COPPER STEAM SPARGERS AND STEAM INLET CONNECTIONS ARE PROVIDED WITH ALL NECESSARY FITTINGS. STANDARD INSTRUMENTATION SUPPLIED FOR STEAM HEATED UNITS REMAINS THE SAME AS THAT SUPPLIED FOR ELECTRICALLY HEATED UNITS.

FLOW DIAGRAM (ELECTRICALLY HEATED)

Fig. 2



Telephone : 386 3284

Gram : CHLORINATE

Manufacture, Sales & Service By

BABUBHAI NAROTAMDAS & CO.

OFFICE : NAROTAM NIVAS, NANA CHOWK, 308, JAWAJI DADAJI ROAD, BOMBAY-400 007.

FACTORY : P-1, CAMA INDUSTRIAL ESTATE, WALBHAT RD, GOREGAON (E), BOMBAY-400 063. PHONE : 673 2182 / 673 3048 / 673 53 16

OWNER:	PUNJAB STATE ELECTRICITY BOARD PATIALA
PROJECT:	2 X 250MW GHTP LEHRA MOHABBAT THERMAL POWER PROJECT STAGE – II, UNITS 3 & 4
OWNER'S CONSULTANT:	TCE CONSULTING ENGINEERS LIMITED BANGALORE
CONTRACTOR:	BHARAT HEAVY ELECTRICALS LTD. POWER SECTOR PROJECT ENGINEERING MANAGEMENT- NEW DELHI
ENGINEERING SUB CONTRACTOR:-	FICHTNER CONSULTING ENGINEERS(INDIA) PVT. LTD. CHENNAI.
VENDOR	BABUBHAI NAROTTAMDAS & CO. 'BANACO HOUSE' P-1, CAMA INDUSTRIAL ESTATE, WALBHAT ROAD, GOREGAON (EAST), MUMBAI - 400063

Prepared by	Checked by	Approved by	TITLE: -
PBP	VKM	DRK	CHLORINATOR FOR RW SYSTEM

BHEL DOC NO. – PE-DC-226-174-A017	DOCUMENT NO. – BNC/A/1115/DS/07 (SHEET 1 OF 5)	REV. – R1

RECORD OF REVISIONS

Rev. No.	Date	Revision Details	Revised by	Approved by
R0	24/12/05	FOR APPROVAL		
R1	23/02/06	Submission for Client approval		

TECHNICAL DATA SHEET

BANACO BABUBHAI NAROTAMDAS & CO. BANACO House, P-1 Cama Ind Estate, Walbhat Road, Goregaon (E), Mumbai - 400 063 Phone: 2685 1386, 5699 7530 Fax: 022-2685 2182	DOC NO REV NO DATE DESCRIPTION	: BNC/A/1115/DS/07 : R1 : 26/02/06 : Chlorinator Model V-711 For RW System
BHEL DOC NO :PE-DC-226-174-A017	SHEET NO.	: 3 of 5.
P&I DIAGRAM NO.	:	BNC/4473

1.0	**Make**	: BANACO
2.0	**Standard**	: IS:10553 Part 2
3.0	**Quantity**	: 2 Nos(1W + 1S)
4.0	**Model**	: V-711
5.0	**Mounting**	: Floor Mounted
6.0	**Tag No.**	: CHLR -3 & CHLR - 4.
7.0	**Maximum capacity/Unit**	: 24.0 Kg/Hr
8.0	**Minimum Capacity/Unit**	: 1.2 Kg/Hr
9.0	**Accuracy**	: +/- 4%
10.0	**Feed Adjustment**	: Manual
11.0	**Major components of Chlorinator** **Vacuum Regulating Valve**	
	Number/Unit	: 1 No/Unit
	Type	: Vacuum operated diaphragm type
	Material	: Body: Ebonite, Diaphragm: PTFE Spring:Hastealloy 'C' , Seat : PTFE, Trim : Mone Fastners: Monel
12.0	**Pressure & vacuum relief valve(Inbuilt with Vacuum Regulator).**	
	Make and type	: BA CO make, Spring Loaded Type.
	Material	: Body : PVC, Spring : Hastealloy 'C' Seat: PTFE Loading Bolt : PVC, 'O' ring : Viton Trim : Monel,Fastners: Monel
	Set Pressure	: 0.7 Kg/Sq.Cm(g)
	Blow down value	: 0.64Kg/Sq.Cm(g) (Tolerance +/-4%)
13.0	**External Ejector with Inbuilt Check Valve**	
	Number/Unit	: 1 No/ Unit.
	Type	: Fixed Type
	Water flow rate/ unit	: 12.0 cu.m/hr

TECHNICAL DATA SHEET

BANACO
BABUBHAI NAROTAMDAS & CO.
BANACO House, P-1 Cama Ind Estate,
Walbhat Road, Goregaon (E), Mumbai - 400 063
Phone: 2685 1386, 5699 7530 Fax: 022-2685 2182

BHEL DOC NO :PE-DC-226-174-A017	
DOC NO	: BNC/A/1115/DS/07
REV NO	: R1
DATE	: 26/02/06
DESCRIPTION	: Chlorinator Model V-711 For RW System
SHEET NO.	: 4 of 5
P&I DIAGRAM NO.	: BNC/4473

Motive water pressure : 5.0 Kg/Sq.cm (g).

Material
1. Ejector : Body: MS FRP Lined, Jet & Throat: Ebonite Fastners: SS 304,Gasket:Rubber
2. Check Valve : Body: PVC, Seat: PTFE, Valve PVC

14.0 Flow Rate Adjusting Device (Flow Control Valve)

Number/Unit : 1 No.

Type and make : BANACO make, Manual Adjustment Needle Type

Material : Body: PVC, Seat: PTFE, 'O' Ring : Viton

15.0 Chlorine Gas Flow Indicator

Number/Unit : 1 No.

Type and make : BANACO make, Rotameter Type.

Range/Division : Range :-20:1/ Division :- KG/Hr
Min:- 1.2Kg/Hr & Max.:- 24Kg/Hr

Least Count : 0.5 Kg/Hr
Material : Borosilicate Glass, Float: PTFE
Calibration : Required for 1.2 Kg/Hr -24 kg/hr, Acc. +/- 4%

16.0 Gas Filter

Number : 1 No.(In Built with vacuum regulator)

Material : Body : Monel
Filter media : Spun Fibre Glass Wool

17.0 Drain valve

Number/Unit : 1 No./ Unit

Type and make : BANACO make, Spring Loaded Type.

Material : Body: PVC, Seat : PTFE, 'O' Ring : Viton
Spring: Hastealloy 'C'

18.0 Cabinet

Overall size/Unit : 580mmWidth x 1470mmHt x 390mm Depth
Material : FRP
Total shipping weight : 35 Kg

TECHNICAL DATA SHEET

BANACO
BABUBHAI NAROTAMDAS & CO.
BANACO House, P-1 Cama Ind Estate,
Walbhat Road, Goregaon (E), Mumbai - 400 063
Phone: 2685 1386, 5699 7530 Fax: 022-2685 2182

DOC NO	: BNC/A/1115/DS/07
REV NO	: R1
DATE	: 26/02/06
DESCRIPTION	: Chlorinator Model V-711 For RW System
SHEET NO.	: 5 of 5

BHEL DOC NO :PE-DC-226-174-A017

P&I DIAGRAM NO. : BNC/4473

19.0 Tag Nos of Instrument Mounted on Chlorinator

Description	Instrument Tag Nos.
Chlorine Pressure Gauge	PI-18 & PI-19
Vacuum Gauge	VI-3 & VI-4

20.0 Tests/Inspection : As per Approved Quality Plan

21.0 Reference Documents
Data sheet for instruments : Catalogue CX/302

Installation

The cabinet must be installed vertically and fastened to the floor. A mounting pedestal block is desirable but not necessary.

Trained Service Engineers are prepared to install and service our equipment at extra cost.

Required accessories **Included with chlorinator as specified in offer.**

Flexible connectors and valves for chlorine gas supply (manifold when necessary).
Piping for chlorine solution drain and vent.
Chlorine solution diffuser (Injection fitting for pressure pipe line application).

Optional accessories

In addition to the required accessories, one or more of the following equipment items may be required or desired, for a particular installation.

1. Chlorine Scale (weigh machine)
2. Booster Pump
3. Colorimetric Comparator (Test Set)
4. Gas Mask
5. Check valve for chlorine solution line

All accessories are available from Babubhai Narotamdas & Co. and can be supplied at extra cost.

Item (2) is Required when water supply pressure is insufficient to operate the Chlorinator.

Operation

As water under pressure flows through the ejector assembly, a vacuum is created at the ejector. This vacuum exists at reduced values back through the differential pressure regulator the manual rate valve, the chlorine flowmeter and the vacuum regulator. The differential pressure regulator and the vacuum regulator are stacked to form a single unit the chlorine regulator.

The vacuum in the vacuum regulator moves a diaphragm which unseats the inlet valve, reducing the chlorine gas from supply pressure to water column vacuum.

The Chlorine gas then passes through the flowmeter, the manual rate valve and into differential pressure regulator. This regulator maintains a constant pressure drop across the rate valve. From the regulator, the gas flows to the ejector where the chlorine mixes with water to form chlorine solution, which is carried through the distribution system to the point of application.

Semi-automatic, or start-stop operation, is accomplished by starting and stopping the water flow through the ejector by a solenoid valve or other means.

Short from technical data for the V-711

Type Operation
Vacuum

Control
Manual or Semi automatic

Capacities

Standard	g/h	60	120	200	400	800	1500	2000	4000	8000	14 kg/h	20 kg/h	40 kg/h
Maximums	PPD	3	6	10	20	40	75	100	200	400	700	1000	2000

Range of operation
20 : 1 set by hand

Accuracy
4%

Cabinet
Fibreglass reinforced with polyester-grey colour

Dimensions
Width 58 cm Height 147 cm Depth 39 cm

Weights
Net 35 kg approximately Gross 80 kg in wooden box approximately

Volume (packed)
0.4 m^3 in carton approximately 0.6 m^3 in woodenbox approximately

We reserve the right to make design improvements and other changes at any time we feel it desirable to do so.

TELEPHONE: 36 32 84

GRAM: CHLORINATE

Manufacture, Sales and Serviced by

BABUBHAI NAROTAMDAS & CO.

Office:

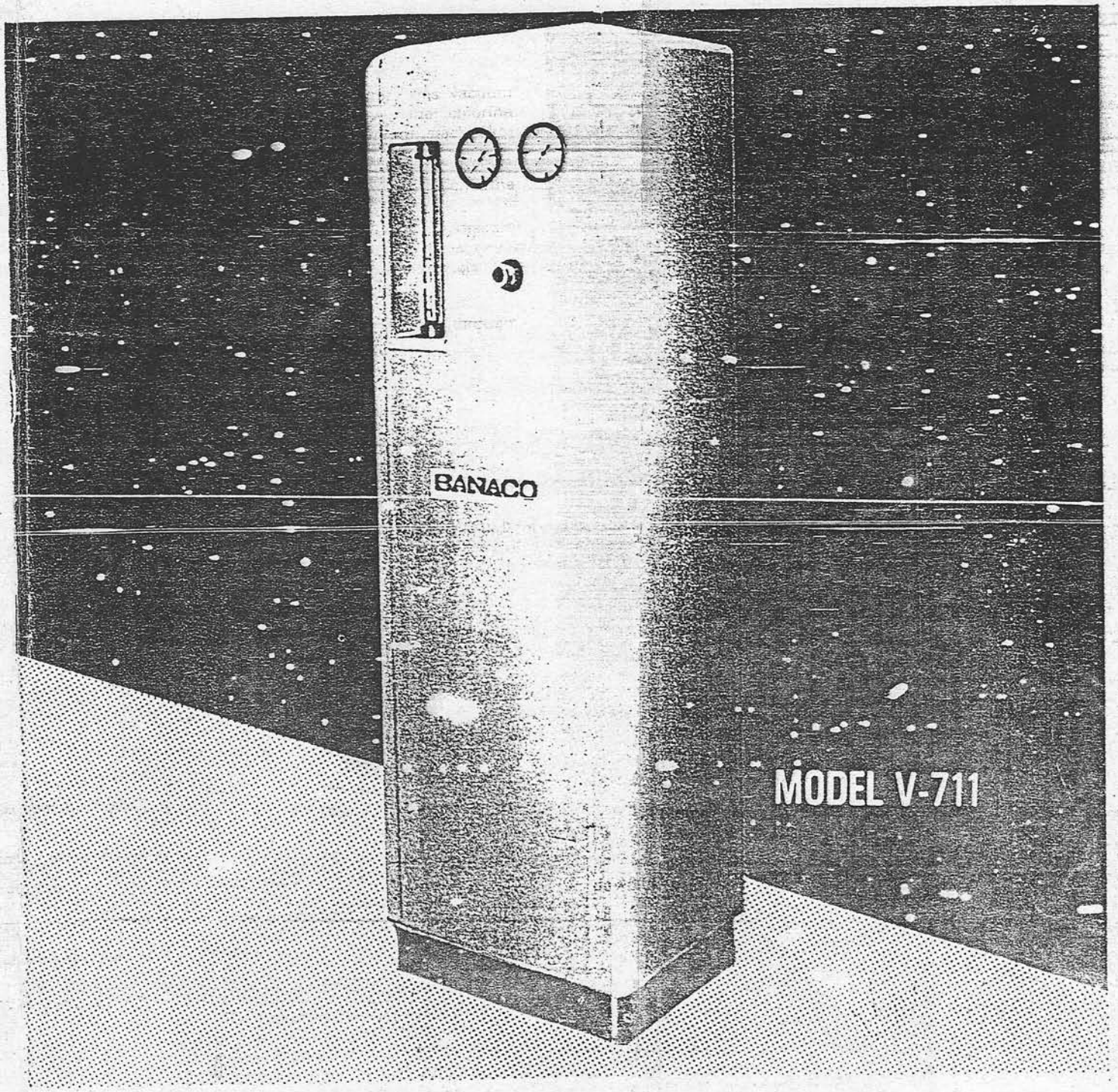
NAROTAM NIWAS NANA CHOWK,
308, JAWAJI DADAJI ROAD,
BOMBAY-400 007.

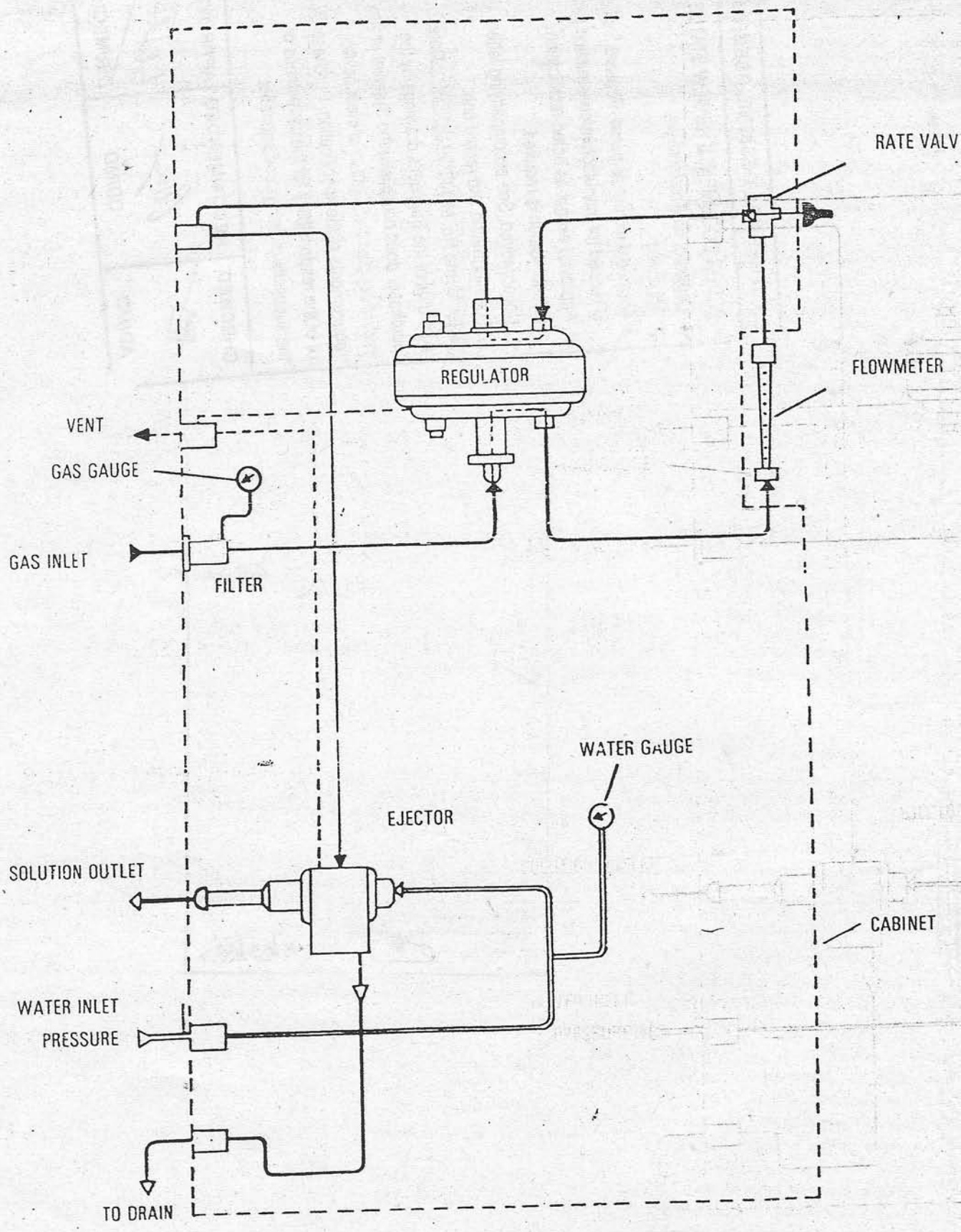
Correspondence Address & Factory:
P-1, CAMA INDUSTRIAL ESTATE,
WALBHAT ROAD, GOREGAON (EAST)
BOMBAY-400 063. PHONE: 695386/693048
TELEX-NO 011-78257

BANACO

AUTOMATIC VACUUM TYPE

CHLORINATOR GAS FEEDER





FOR WATERWORKS, SWIMMING POOLS, POWER STATIONS, SEWAGE WORKS, FOOD FACTORIES, DAIRIES, INDUSTRIAL PROCESSES AND TRADE EFFLUENTS

BANACO

EQUIPMENT DATA

Manual or Semi-automatic Chlorinator model V-711

The Model V-711 Chlorinator is a manually operated solution feed, vacuum type Chlorinator designed to feed chlorine gas of a controlled rate. This Chlorine gas flow rate is maintained constant positive-acting, spring-opposed diaphragm regulators.

Rate setting

Manual adjustment at the rate valve located on front of cabinet.

Capacity

40 kg/h, or 2000 PPD (pounds chlorine per 24 hours) maximum.

Range

Within the basic 40 kg/h, capacity, the Chlorinator is capable of operating over flow ranges of 20 to 1. These ranges are dependent upon the flowmeter used. Standard meters available are listed in the Table:

Metric System

3- 60 g Cl_2/h	6-120 g Cl_2/h	10- 200 g Cl_2/h	20-- 400 g Cl_2/h
40- 800 g Cl_2/h	60-1500 g Cl_2/h	100-2000 g Cl_2/h	200-4000 g Cl_2/h
400-8000 g Cl_2/h	0.7- 14 kg Cl_2/h	1.0- 20 kg Cl_2/h	2.0- 40 kg Cl_2/h

English system

0.1- 3.0 PPD	0.3- 6.0 PPD	0.5- 10 PPD	1.0- 20 PPD
2.0- 40 PPD	3.0- 75 PPD	5.0- 100 PPD	10- 200 PPD
20-400 PPD	30-700 PPD	50-1000 PPD	100-2000 PPD

High Chlorine flow rates can be decreased (the range shifted to one of lower maximum capacity) simply by replacing the chlorine flowmeter with one of lower capacity. Low chlorine flow rates can be increased by replacing the chlorine flowmeter with one of higher capacity. In most cases increasing the capacity also necessitates changing component parts in the manual rate valve and ejector.

Accuracy

Within 4%

Water requirements

The water supply flow rate and pressure requirements depend upon the maximum chlorine capacity and back presusre at the outlet of the ejector. The back pressure Includes the pipe frictional losses between the Chlorinator and the point of application plus the existing back pressure at the point of application.

Semi-automatic operation

The chlorine regulator will only permit gas flow when the ejector furnishes sufficient vacuum. To operate the Chlorinator it is only necessary to initiate the ejector water flow. To stop the Chlorinator it is necessary to interrupt the water flow. This "on-off" operation, is sometimes called Semi-automatic operation. It can be accomplished by opening and closing a solenoid valve in the ejector water line

Materials of construction

The Chlorinator is constructed of materials which are resistant to the corrosive action of dry and moist chlorine gas and chlorine solution where necessary. These materials have over 15 years proven performance in this service.

Chlorinator Cabinet Natural unpainted gray polyester plastic reinforced with fibreglass
Regulator Body EBONITE PVC, or ABS
Regulator Diaphragms PTFE or PVC
Regulator Valve Plug Silver
Manual Rate Valve (plug and seat) Silver
Ejector Block Ebonite PVC or ABS
Springs Silver-plated Silver alloy
Overflow and Check Valves Precision balls and Seats PTFE or PVC
Chlorine Gas Pressure Piping Copper Silver Plated
Chlorine Gas Vacuum Piping PVC
Chlorine Gas Pressure Gauge Filled Bourdon tube type protected with silver diaphragm
Flowmeter Tubes Heavy-wall, Precision-bore Glass-Borosilicate
Metering Floats (low flow rates) PVC or PTFE
Metering Floats (high flow rates) Precision-machined silver or PVC

C.E./THERMAL DESIGNE, PSEB, PATIALA

VENDOR DOCUMENTS REVIEW STATUS

1. Copies of final distribution.
2. Approved.
3. Approved except as noted. Forward final drgs. (Proceed for manufacture/construction parallely.)
4. Approved except as noted rectification. Resubmission is required.
5. Not approved. See accompanying letter.
6. For information and record only.

Refer Memo No. MD-III/79.8/5586/87 Date. [illegible]

Approval of the Supplier's drawings by the purchaser does not relieve the Supplier or any part of supplier's obligation to meet all the requirements of the specification, Purchase Order or of the responsibility for the correctness of the supplier's drawings or documents.

CHECKED	RECOMMENDED	APPROVED
[signature]	[signature]	[signature]
AD/MD	DD/MD	DIR/MECH.

617 NDT/02

15/03/02

16/03/02

ANNEXURE-VI

QAP

BANACO

Phone : 022-2685 13 86
5699 7530
5699 7531
Fax : 022-26852182
E-mail : banaco@bom5.vsnl.net.in.

Our Ref: BNC/A/1115/VK-8/06

Date: 04/03/06

M/s BHARAT HEAVY ELECTRICALS LTD
Power Sector – PEM-PSG:CCP
BHEL House, Siri Fort
New Delhi – 110049

By Courier

Kind Attn. Mr. Satinder P Gupta
Addl General Manager

SUB : Submission of Drawing for approval

REF : Chlorination Plant for Lehra Mohabbat 2 x 250MW GHTPS, Unit 3 & 4 Punjab

Dear Sir,

With reference to the above, please find attach here with 6 Copies of following documents for Approval

Sr.No	Description	BHEL DOC No.	VENDOR DOC NO.
1	CW Chlorination Control panel	PE-DG-226-174-A064	BNC/4389-CW
2	Quality Control Plan	PE-QP-226-174-A069	BNC/A/1115/QCP /05

Request you to send us one copy back duly stamped as Approved.

Thanking you

Yours Faithfully
For Babubhai Narottamdas & Co.

Prashant Kocha
Head – Matl & Proj.

Encl.: 6 Sets of above

C.C. To.

1. Fichtner Consulting Engineers(I) Pvt Ltd.
   Ganesh Chambers, 64 Eldams Road
   Chennai 600 018.
   Attn.: Mr.R.P. Pillai
   Project Manager
   With 4 copies of above

2. M/s Bharat Heavy Electricals Ltd
   Power Sector-Northern Region
   HRDI & PSNR Complex
   Plot No 25 Sector 18A, Noida – 201301
   Attn.: Mr. V.K.Gupta
   For Information
   By Fax. 0120 2515465

BABUBHAI NAROTTAMDAS & CO.
'Banaco House',
P-1, Cama Industrial Estate,
Walbhat Road, Goregaon (East),
Mumbai - 400 063. (India)

Manufacturing Quality Plan

BABUBHAI NAROTTAMDAS & CO.

Mfr's Name :

~~QUALITY CONTROL PLAN~~

OWNER : PUNJAB STATE ELECTRICITY BOARD-PATIALA
OWNERS CONSULTANT : TCE CONSULTING ENGINEERS LTD.-BANGALORE
CONTRACTOR : Bharat Heavy Electricals Ltd. New Delhi
ENGG SUB CONTRACTOR : Fichtner Consulating Engineers (I) Pvt. Ltd. Chennai
PROJECT: 2 x 250 MW, GHTPS, LEHRA MOHABBAT(UNIT-3&4)
PACKAGE : CW, RW & PW CHLORINATION SYSTEM

Our Ref: : BNC/A/1115/QCP/05
REV. NO. : 0
Date : 17/02/06
BHEL DOC No.PE-QP-226-174-A069

SR. NO.	COMPONENT / OPERATION.	CHARACTERISTICS TO BE CHECKED.	CATEGORY.	EXTENT OF CHECK	REF. DOCUMENTS/ ACCEPTANCE NORMS.	FORMAT OF RECORD	INSPECTION BY (X)	(Y)	(Z)
A	**Chlorine Tonne Containers**						M	C	B
1	Raw Materials.								
1.1	Shell & Dished Ends	Review of Material TCs.	MI	100%	Approved Drgs/Data Sheets.	MTC	H	R	R
		Chemical & Physical Properties	MI	100%	Approved Drgs/Data Sheets.	Lab. Rep.	H	R	R
1.2	Siphon Tubes & Valves	Material Identification & Co-relation with MTCs.	MI	100%	Approved Drgs/Data Sheets.	MTC/Lab. Rep.	H	R	R
2	In Process Inspection								
2.1	Welding	WPS, PQR & WPQ.(See Note)	MI	100%	Appl. ASME / BS Codes	Documents	H	W	W
2.2	NDT	RT of Butt Welds.	MI	100%	Appl. ASME / BS Codes	RT Rep.	H	W	W
		PT on all Fillet Welds.	MI	100%	Appl. ASME / BS Codes	PT Rep.	H	W	W
2.3	Heat Treatment	Review of SR Chart.	MI	100%	BS 1500 P-1 / ASME Sec. VIII	SR Chart.	H	W	W
3	Final Inspection								
3.1	Assembly	Visual & Dimensional.	MI	10%	BS 1500 P-1 / Spec.	Insp. Rep.	H	W	W
3.2	Pressure Testing	Hydro Test.	CR	10%	BS 1500 P-1 / Spec.	Test Rep.	H	W	W
3.3	Final Painting	Surface Preparation & DFT of Paint.	MI	100%	BS 1500 P-1 / Spec.	Insp. Rep.	H	W	W
3.4	Certification	Final Markings & Stamping.	MA	10%	BS 1500 P-1 / Spec.	Insp. Rep.	H	W	W
		Certification from CCE.	MI	100%	BS 1500 P-1 / Spec.	Certificate.	H	W	W

Legend : P - Performer, W - Witness, V - Verification.

Category : CR – Critical, MA – Major, MI – Minor.

M - Mfr., C - BANACO, B - BHEL

Legend : ~~H – Hold, W – Witness, R – Review. (Refer enclosed 'Defination of Legends'.~~

~~X – BANACO/SUB CONTRACTOR, Y – BHEL & Z – OWNER/CONSULTANT~~

NOTE (1) Chlorine Tonners Stage & Final will be Inspected by Lloyds Register & Llyods Std certificate stating all stage complied shall be sent, for Review to M/s. BHEL

Final Inspection Stage 3.1, 3.2 & 3.3 will be Offered to ~~BHEL/OWNER/CONSULTANT~~

NOTE (2) Already Approved WPS/PQR shall be applicable(Typ.) & Approved Welder shall be utilised (Typ.)

Prepared By : K.Vasanth

Checked & Approved By : Dr. P.K.Singh

Mfr / BANACO (Sign & stamp)

BHEL use:

Customer's use:

BABUBHAI NAROTTAMDAS & CO.

Mfr's name.

~~QUALITY CONTROL PLAN~~

OWNER : PUNJAB STATE ELECTRICITY BOARD-PATIALA
OWNERS CONSULTANT : TCE CONSULTING ENGINEERS LTD.-BANGALORE
CONTRACTOR : Bharat Heavy Electricals Ltd. New Delhi
ENGG SUB CONTRACTOR : Fichtner Consulating Engineers (I) Pvt. Ltd. Chennai
PROJECT: 2 x 250 MW, GHTPS, LEHRA MOHABBAT(UNIT-3&4)
PACKAGE : CW, RW & PW CHLORINATION SYSTEM

Our Ref. : BNC/A/1115/QCP/05
REV. NO. : 0
Date : 17.02/06
BHEL DOC No.PE-QP-226-174-A069

SR. NO.	COMPONENT / OPERATION.	CHARACTERISTICS TO BE CHECKED.	CATEGORY.	EXTENT OF CHECK	REF. DOCUMENTS/ ACCEPTANCE NORMS.	FORMAT OF RECORD	INSPECTION BY. X	Y	Z
							M	C	B
B	**Evaporator**							W	
1	Raw Materials.								
1.1	Vapourising Chamber, Water Chamber, Tubes	Review of Material TCs.	MI	100%	Appl. Matl. Specs.	MTC	H	R	R
		Chemical & Physical Properties	MI	100%	Appl. Matl. Codes.	Lab. Rep.	H	R	R
		Material Identification & Co-relation with MTCs.	MA	100%	Appl. Matl. Codes.	MTC/Lab. Rep.	H	R	R
1.2	FRP Cabinet	Visual.	MI	100%	Appl. Drgs.	Insp. Rep.	H	R	R
2	In Process Inspection								
2.1	Welding	WPS, PQR & WPQ.(see Note)	MI	100%	Appl. ASME / BS / IS Codes	Documents	H	R	R
2.2	NDT	RT of Butt Welds. (Pressure Boudries)	MI	100%	Appl. ASME / BS / IS Codes	RT Rep.	H	R	R
3.0	Heating Elements	?	?	2	?	?	P?	?	?
4	Final Inspection								
4.1	Assembly	Visual & Dimensional.	MI	100%	Specs. / Drg.	Insp. Rep.	H	W	R W
4.2	Pressure Testing	Hydro Test.(60 kg/cm2 for 5 min.)	CR	100%	Specs. / Drg.	Test Rep.	H	W	R
4.3	Final Painting	Surface Preparation, Galvanising Coat Thk. & DFT of Paint.	MI	100%	Painting Specification	Insp. Rep.	H	R	R V
							P	W	

Refer page 1; and change

Category : CR – Critical, MA – Major, MI – Minor.
Legend : H – Hold, W – Witness, R – Review. (Refer enclosed 'Defination of Legends'.)
X – BANACO/SUB CONTRACTOR, Y – BHEL & Z – OWNER/CONSULTANT
NOTE : Already Approved WPS/PQR shall be applicable(Typ.) & Approved Welder shall be utilised (Typ.)

Prepared By : K.Vasanth
Checked & Approved By : Dr. P.K.Singh

BABUBHAI NAROTTAMDAS & CO.

Mfr's name :

QUALITY CONTROL PLAN

OWNER : PUNJAB STATE ELECTRICITY BOARD-PATIALA
OWNERS CONSULTANT : TCE CONSULTING ENGINEERS LTD.-BANGALORE
CONTRACTOR : Bharat Heavy Electricals Ltd. New Delhi
ENCC SUB CONTRACTOR : Fichtner Consulating Engineers (I) Pvt. Ltd. Chennai
PROJECT: 2 x 250 MW, GHTPS, LEHRA MOHABBAT(UNIT-3&4)
PACKAGE : CW, RW & PW CHLORINATION SYSTEM

Our Ref. : BNC/A/1115/QCP/05
REV. NO. : 0
Date : 17/02/06
BHEL DOC No.PE-QP-226-174-A069

SR. NO.	COMPONENT / OPERATION.	CHARACTERISTICS TO BE CHECKED.	CATEGORY.	EXTENT OF CHECK	REF. DOCUMENTS/ ACCEPTANCE NORMS.	FORMAT OF RECORD	INSPECTION BY. X	Y	Z
C	**Chlorinator & Chlorination Equipment.**								
1	BANACO make Chlorinator								
1.1	Materials for Major Components of Chlorinator.	Visual, Dimensional.	MA	100%	App. Drgs.	IR.	H	R	R
		Chemical & Physical Properties	MA	100%	Relevent Mati. Specification.	Lab Rep.	H	R	R
1.2	BANACO make Filter, Vacuum Regulator, Rotameter, Control Valve, Safety Valves & Ejector.	Workmanship, Finish, Dimension & Calibration.	MA	100%	App. Drgs. / Data Sheet. Catalogue /Mfrs. Spec.	IR / TC.	H	W	R
1.3	Complete Chlorinator (Final Insp.)	Check for Completeness, Workmanship, Dimensions.	CR	100%	App. Drgs. / Data Sheet. Mfrs. Spec.	IR / TC.	H	W	R
2	Trunnion Type Roller Support.	Check for Completeness, Workmanship, Dimensions.	MI	100%	App. Drgs. / Data Sheet.	TC.	H	W	R
3	Expansion Chamber.	Check for Completeness, Workmanship, Dimensions, Hydro – Test.(40 kg/cm2 for 5 min.)	CR	100%	App. Drgs. / Data Sheet.	TC.	H	W	R
4	Chlorine Spray Catcher / Gas Filter.	Check for Completeness Workmanship, Dimensions, Hydro – Test.(40 kg/cm2 for 5 min.)	CR	100%	App. Drgs. / Data Sheet.	TC.	H	W	R
5	Diffuser Assembly	Check for Completeness, Workmanship,	MI	100%	App. Drgs. / Data Sheet.	TC.	H	R	R
6	Caustic Tank & Absorption tower	Dimensions/Orientation check Water fill test for caustic tank only. (Full of water for 8 hrs)	MA	100%	App. Drgs. / Data Sheet.	IR/TC	H	W	R
7	Tonner Lift Bar.	Check for Completeness, Workmanship, Dimensions, TC for Load Test.	MI	100%	App. Drgs. / Data Sheet.	IR.	H	W	R
8	By – Pass Type Rotameter.	Check for Completeness, Workmanship, Dimensions, Review of Calibration Cert	MI	100%	App. Drgs/catalogue. / Data Sh	TC.	H	W	R

Category : CR – Critical, MA – Major, MI – Minor.
Legend : H – Hold, W – Witness, R – Review. (Refer enclosed 'Defination of Legends'.
X – BANACO/SUB CONTRACTOR, Y – BHEL & Z – OWNER/CONSULTANT
NOTE : Already Approved WPS/PQR shall be applicable(Typ.) & Approved Welder shall be utilised (Typ.)

Refer page 1 for Comments

Prepared By : K.Vasanth
Checked & Approved By : Dr. P.K.Singh

BABUBHAI NAROTTAMDAS & CO.

Mfrs name:

QUALITY CONTROL PLAN

OWNER : PUNJAB STATE ELECTRICITY BOARD-PATIALA
OWNERS CONSULTANT : TCE CONSULTING ENGINEERS LTD.-BANGALORE
CONTRACTOR : Bharat Heavy Electricals Ltd. New Delhi
ENGG SUB CONTRACTOR : Fichtner Consulating Engineers (I) Pvt. Ltd. Chennai
PROJECT: 2 x 250 MW, GHTPS, LEHRA MOHABBAT(UNIT-3&4)
PACKAGE : CW, RW & PW CHLORINATION SYSTEM

Our Ref. : BNC/A/1115/QCP/05
REV. NO. : 0
Date ; 17/02/06
BHEL DOC No.PE-QP-226-174-A069

SR. NO.	COMPONENT / OPERATION.	CHARACTERISTICS TO BE CHECKED.	CATEGORY.	EXTENT OF CHECK	REF. DOCUMENTS/ ACCEPTANCE NORMS.	FORMAT OF RECORD	INSPECTION BY. X	Y	Z
9	Pressure Indicator.	Check for Completeness, Workmanship, Dimensions, Review of Calibration Cert.	MI	100%	App. Drgs. / Data Sheet	TC.	H	W	R
10	Pressure Switches & Differential Pressure Switches, Temperature switches	Check for Completeness, Workmanship, Dimensions, Review of Calibration Cert.	MI	100%	Catalogue. / Data Sheet.	TC.	H	W	R
11	Temperature Indicator.	Check for Completeness, Workmanship, Dimensions, Review of Calibration Cert	MI	100%	Catalogue. / Data Sheet.	TC.	H	W	R
12	Chlorine Leak Detector.	Workmanship,Finish Review of TCs.	CR	100%	Catalogue. / Data Sheet.	IR / TC.	H	W	R
13	Chlorine Residual Analyser.	Workmanship,Finish Review of Mfrs. TCs.	CR	100%	Catalogue. / Data Sheet.	IR / TC.	H	W	R
14	Safety Items.								
14.1	Canister Type Gas Mask.	Workmanship, Finish.	MI	100%	Catalogue. / Data Sheet.	IR.	H	W	R
14.2	Emergency Repair Kit	Workmanship, Finish.	MI	100%	Catalogue. / Data Sheet.	IR.	H	W	R
14.3	Safety Shower & Eye Wash	Workmanship, Finish, Dimensions	MI	100%	App. Drgs./Data sheet	IR.	H	W	R
14.4	Self contained Breathing Apparatus	Workmanship, Finish.Review of Mfrs TCs.	MI	100%	Catalogue. / Data Sheet.	TC.	H	W	R
14.5	Ammonia Torches	Workmanship, Finish	MI	100%	Catalogue. / Data Sheet.	IR.	H	W	R
14.6	Weather Socks	Workmanship, Finish.	MI	100%	Catalogue. / Data Sheet.	IR.	H	W	R

Category : CR – Critical, MA – Major, MI – Minor.
Legend : H – Hold, W – Witness, R – Review. (Refer enclosed 'Defination of Legends'.
X – BANACO/SUB CONTRACTOR, Y – BHEL & Z – OWNER/CONSULTANT
NOTE : Already Approved WPS/PQR shall be applicable(Typ.) & Approved Welder shall be utilised (Typ.)

Refer page-1 for Comments

Prepared By : K.Vasanth
Checked & Approved By : Dr. P.K.Singh

BABUBHAI NAROTTAMDAS & CO.

Mfrs name;

~~QUALITY CONTROL PLAN~~

OWNER : PUNJAB STATE ELECTRICITY BOARD-PATIALA
OWNERS CONSULTANT : TCE CONSULTING ENGINEERS LTD.-BANGALORE
CONTRACTOR : Bharat Heavy Electricals Ltd. New Delhi
ENGG SUB CONTRACTOR : Fichtner Consulating Engineers (I) Pvt. Ltd. Chennai
PROJECT: 2 x 250 MW, GHTPS, LEHRA MOHABBAT(UNIT-3&4)

Our Ref. : BNG/A/1115/QCP/05
REV. NO. : 0
Date : 17/02/06

PACKAGE : CW, RW & PW CHLORINATION SYSTEM

BHEL DOC No.PE-QP-226-174-A069

SR. NO.	COMPONENT / OPERATION.	CHARACTERISTICS TO BE CHECKED.	CATEGORY.	EXTENT OF CHECK	REF. DOCUMENTS/ ACCEPTANCE NORMS.	FORMAT OF RECORD	INSPECTION BY. X (M)	Y (C)	Z (B)
15	Valves. Pl. furnish QP for each type of valves separately.	Check for Completeness, Workmanship, Dimensions, Hydro – Test, Review of Mfrs. TCs.	CR	100%	App.drg/Catalogue. / Data She	TC. P	H	W	R
16	Strainers Pl. furnish QP. for different type of strainer	Check for Completeness, Workmanship, Dimensions, Hydro – Test., Press. drop.	CR	100%	App.drg/Catalogue. / Data She	TC.	H	W	R V
17	Pipes & Fittings & Piping works separately	Workmanship, Finish, Dimensions Review of Mfrs. TCs.	MI	100%	App. Drgs.	TC.	H	W	R V
18	Weighing scale (Platform type & Crane weigher type).	Workmanship, Finish, Dimensions Review of Mfrs. TCs.	MI	100%	App.drg/Catalogue. / Data She	weights & measu certificate	H	W	R
19	Plant Control Panel. Furnish separate QP.	Workmanship, Finish, Dimensions Functional Test.	CR	100%	App. Drgs.	IR / TC.	H	W	R W,
20	Commissioning & Performance Flowmeter, Control Valve, Testing/Acceptance Test (At Site).	Leakage's, Performances & Accuracy.	CR	100%	App. Drgs. / Data Sheet/ Specification.	Insp. Rep.	H	W	R V,

Pl. furnish separate QPs for R/L CS lined, GI, & ~~other pipes~~ PVC / CPVC as applicable in the system.

Category : CR – Critical, MA – Major, MI – Minor.
Legend : H – Hold, W – Witness, R – Review, (Refer enclosed 'Defination of Legends'.
X – BANACO/SUB CONTRACTOR, Y – BHEL & Z – OWNER/CONSULTANT
NOTE : Already Approved WPS/PQR shall be applicable(Typ.) & Approved Welder shall be utilised (Typ.)

Refer page 1 for comments.

Prepared By : K.Vasanth
Checked & Approved By : Dr. P.K.Singh

144

BABUBHAI NAROTTAMDAS & CO.

Mfr's name:

~~QUALITY CONTROL PLAN~~

OWNER : PUNJAB STATE ELECTRICITY BOARD-PATIALA
OWNERS CONSULTANT : TCE CONSULTING ENGINEERS LTD. BANGALORE
CONTRACTOR : Bharat Heavy Electricals Ltd. New Delhi
ENGG SUB CONTRACTOR : Fichtner Consulating Engineers (I) Pvt. Ltd. Chennai
PROJECT: 2 x 250 MW, GHTPS, LEHRA MOHABBAT(UNIT-3&4)
PACKAGE : CW, RW & PW CHLORINATION SYSTEM

Our Ref. : BNC/A/1115/QCP/05
REV. NO. : 0
Date : 17/02/06
BHEL DOC No.PE-QP-226-174-A069

SR. NO.	COMPONENT / OPERATION.	CHARACTERISTICS TO BE CHECKED.	CATEGORY.	EXTENT OF CHECK	REF. DOCUMENTS/ ACCEPTANCE NORMS.	FORMAT OF RECORD	INSPECTION BY. X	Y	Z
1	Centrifugal Pump.	Review of Mfr's. TC's	MI	100%	Appd Drgs/data Sheets	TC	H	R	R
		Hydrotest of Body.	MA	100%	Appd Drgs/data Sheets	IR/TC	H	R	(R) W
		Dynamic balancing of Impeller	MA	100%	Appd Drgs/data Sheets	IR/TC	H	R	(R) W
		Workmanship, Finish, Dimensions.	MI	100%	Appd Drgs/data Sheets	IR/TC	H	R	(R) W
		Performance Test.	MA	100%	Appd Drgs/data Sheets	IR/TC	H	W	(R) W
2	~~Motor for the Pump.~~ Furnish QP as per spec.	Motor Type Test	MI	100%	IS:325	Test Report	H	R	(R)
		Motor Routine Test	MI	100%	IS:325	Test Report	H	R	(R)
3	Base Plate	Review of Mfr's. TC's.	MI	100%	Appd Drgs/data Sheets	IR/TC	H	R	(R) V
		Workmanship, Finish, Dimensions.	MI	100%	Appd Drgs/data Sheets	IR/TC	H	W	(R)

Category : CR – Critical, MA – Major, MI – Minor.
Legend : H – Hold, W – Witness, R – Review. (Refer enclosed 'Defination of Legends') Refer page 1 for comments.
X – BANACO/SUB CONTRACTOR, Y – BHEL & Z – OWNER/CONSULTANT
NOTE : Already Approved WPS/PQR shall be applicable(Typ.) & Approved Welder shall be utilised (Typ.)

Prepared By : K.Vasanth
Checked & Approved By : Dr. R.K.Singh

BABUBHAI NAROTTAMDAS & CO.

Mfr's name:

QUALITY CONTROL PLAN

OWNER : PUNJAB STATE ELECTRICITY BOARD-PATIALA
OWNERS CONSULTANT : TCE CONSULTING ENGINEERS LTD.-BANGALORE
CONTRACTOR : Bharat Heavy Electricals Ltd. New Delhi
ENGG SUB CONTRACTOR : Fichtner Consulating Engineers (I) Pvt. Ltd. Chennai
PROJECT: 2 x 250 MW, GHTPS, LEHRA MOHABBAT(UNIT-3&4)
PACKAGE : CW, RW & PW CHLORINATION SYSTEM

Our Ref. : BNC/A/1115/QCP/C5
REV. NO. : 0
Date : 17/02/06
BHEL DOC No.PF-QP-226-174-A069

SR. NO.	COMPONENT / OPERATION.	CHARACTERISTICS TO BE CHECKED.	CATEGORY.	EXTENT OF CHECK	REF. DOCUMENTS/ ACCEPTANCE NORMS.	FORMAT OF RECORD	INSPECTION BY. X	Y	Z
1	Centrifugal Blower.	Review of Mfr's. TC's	MI	100%	Appd Drgs/data Sheets	TC	H	R	R
		Hydrotest of Body.	MA	100%	Appd Drgs/data Sheets	IR/TC	H	R	R
		Dynamic balancing of Impeller	MA	100%	Appd Drgs/data Sheets	IR/TC	H	R	R
		Workmanship, Finish, Dimensions.	MI	100%	Appd Drgs/data Sheets	IR/TC	H	R	R
		Performance Test.	MA	100%	Appd Drgs/data Sheets	IR/TC	H	W	R
2	Motor for the Pump (Blower furnish QP separately.)	Motor Type Test	MI	100%	IS:325	Test Report	H	R	R
		Motor Routine Test	MI	100%	IS:325	Test Report	H	R	R
3	Base Plate	Review of Mfr's. TC's.	MI	100%	Appd Drgs/data Sheets	IR/TC	H	R	R
		Workmanship, Finish, Dimensions.	MI	100%	Appd Drgs/data Sheets	IR/TC	H	W	R

Category : CR – Critical, MA – Major, MI – Minor.
Legend : H – Hold, W – Witness, R – Review. (Refer enclosed 'Defination of Legends'.
X – BANACO/SUB CONTRACTOR, Y – BHEL & Z – OWNER/CONSULTANT
NOTE : Already Approved WPS/PQR shall be applicable(Typ.) & Approved Welder shall be utilised (Typ.)

Reply page 1 for Comments.

Prepared By : K.Vasanth
Checked & Approved By : Dr. P.K.Singh

BABUBHAI NARROTTAMDAS & CO.

Mfr's name:

~~QUALITY CONTROL PLAN~~

OWNER : PUNJAB STATE ELECTRICITY BOARD-PATIALA
OWNERS CONSULTANT : TCE CONSULTING ENGINEERS LTD.-BANGALORE
CONTRACTOR : Bharat Heavy Electricals Ltd. New Delhi
ENGG SUB CONTRACTOR : Fichtner Consulating Engineers (I) Pvt. Ltd. Chennai
PROJECT: 2 x 250 MW, GHTPS, LEHRA MOHABBAT(UNIT-3&4):
PACKAGE : CW, RW & PW CHLORINATION SYSTEM

Our Ref. : BNC/A/1115/QCP/05
REV. NO. : 0
Date : 17/02/06
BHEL DOC No.PE-QP-226-174-A069

SR. NO.	COMPONENT / OPERATION.	CHARACTERISTICS TO BE CHECKED.	CATEGORY.	EXTENT OF CHECK	REF. DOCUMENTS/ ACCEPTANCE NORMS.	FORMAT OF RECORD	INSPECTION BY. X	Y	Z
1	Control Panel	Review of Mfr's. TC's	MI	100%	Appd Drgs/data Sheets	TC	H	R	R
		Workmanship, Finish, Dimensions.	MI	100%	Appd Drgs/data Sheets	IR/TC	H	R	R
		Performance Test.	MA	100%	Appd Drgs/data Sheets	IR/TC	H	W	R

Category : CR – Critical, MA – Major, MI – Minor.
Legend : H – Hold, W – Witness, R – Review. (Refer enclosed 'Defination of Legends'.
X – BANACO/SUB CONTRACTOR, Y – BHEL & Z – OWNER/CONSULTANT
NOTE : ~~Already Approved WPS/PQR shall be applicable(Typ.) & Approved Welder shall be utilised (Typ.)~~

Refer Page 1 for comments.

Prepared By : K.Vasanth
Checked & Approved By : Dr. P.K.Singh

ABUBHAI NAROTTAMDAS & CO.

Mfrs name:

QUALITY CONTROL PLAN

OWNER : PUNJAB STATE ELECTRICITY BOARD-PATIALA	Our Ref. : BNC/A/1115/QCP/05
OWNERS CONSULTANT : TCE CONSULTING ENGINEERS LTD.-BANGALORE	REV. NO. : 0
CONTRACTOR : Bharat Heavy Electricals Ltd. New Delhi	Date : 17/02/06
ENGG SUB CONTRACTOR : Fichtner Consulating Engineers (I) Pvt. Ltd. Chennai	
PROJECT: 2 x 250 MW, GHTPS, LEHRA MOHABBAT(UNIT-3&4)	
PACKAGE : CW, RW & PW CHLORINATION SYSTEM	BHEL DOC No.PE-QP-226-174-A069

SR. NO.	COMPONENT / OPERATION.	CHARACTERISTICS TO BE CHECKED.	CATEGORY.	EXTENT OF CHECK	REF. DOCUMENTS/ ACCEPTANCE NORMS.	FORMAT OF RECORD	INSPECTION BY. X	Y	Z

DEFINATION OF LEGENDS

HOLD

Vendor / Contractor shall give advance notice to Inspection Agency for the specification HOLD point. After Inspection the Inspection Report shall be prepared by the Inspection Agency.Vendor / Contractor shall not proceed with further operation without written clearance or written waival from the Inspection Agencyfor whom the HOLD point is indicated. In case, of Waival, the Vendor / Contractor shall submit records of Inspection carried out to the concerned Inspection Agency for review and clearance prior to dispatch of the item.

WITNESS

Vendor / Contractor shall give advance notice to Inspection Agency for the specification WITNESS point. After Inspection the Inspection report shall be prepared by the Inspection Agency.

In case, Inspection Agency is not able to visit within the specified time, Vendor / Contractor may proceed with Inspection and further operation. Records of inspection carried out by the Vendor / Contractor shall be subject to Review by the concerned Inspection Agency prior to clearance.

MONITOR

Vendor / Contractor shall not give any notice to Inspection Agency for this stage. The Inspection Agency shall have the right to inspect any on-going activity at any time during execution of work.

REVIEW

Record of Inspection carried out by the Vendor / Contractor with the necessary documents shall be offered to the concerned Inspection Agency who shall review for compliance with applicable specifications and give clearance.

Category : CR – Critical, MA – Major, MI – Minor.

Legend : H – Hold, W – Witness, R – Review. (Refer enclosed 'Defination of Legends'.

Refer page 1 for comments.

X – BANACO/SUB CONTRACTOR, Y – BHEL & Z – OWNER/CONSULTANT

NOTE : Already Approved WPS/PQR shall be applicable(Typ.) & Approved Welder shall be utilised (Typ.)

Prepared By : K.Vasanth

Checked & Approved By : Dr. P.K.Singh

SECTION – C2

SPECIFIC TECHNICAL REQUIREMENTS FOR ELECTRICAL

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER :

a) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
b) Electrical load requirement for Chlorination Plant.
c) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

3.1 Bidder shall confirm total compliance to the electrical specification without any deviation from the technical/ quality assurance requirements stipulated. In line with this, signed and stamped copy of the following shall be furnished by the bidder as technical offer:
a) A copy of this sheet “Electrical Equipment Specification for “Chlorination Plant”.
b) Electrical load requirement

3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

ELECTRICAL LOAD FORMAT

LOAD TITLE	RATING (KW / A)		UNIT (U)/STN (S)	Nos.		VOLTAGE CODE*	FEEDER CODE**	EMER. LOAD (Y)	CONT.(C)/ INTT.(I)	STARTING TIME >5 SEC (Y)	LOCATION	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONTROL CODE	REMARKS	LOAD No.
	NAME PLATE	MAX. CONT. DEMAND (MCR)		RUNNING	STANDBY								SIZE CODE	NOs				
1 2		3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

NOTES: 1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)

2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (cc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V

: ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTER CONTROLLED)

BHEL	**LOAD DATA (ELECTRICAL)**	JOB NO.	226	ORIGINATING AGENCY		PEM (ELECTRICAL)
		PROJECT TITLE	2X250 MW, GHTP STAGE-II,LEHERA MOHABAT UNIT 3 & 4	NAME		DATA FILLED UP ON
		SYSTEM	GAS CHLORINATION PLANT.	SIGN.		DATA ENTERED ON
		DEPTT. / SECTION	ELECTRICAL	SHEET 1 OF 1	REV. 00	DE'S SIGN. & DATE

SECTION – D1
GENERAL TECHNICAL REQUIREMENT FOR MECHANICAL

PUNJAB STATE ELECTRICITY BOARD

From

The Chief Engineer,
Thermal Designs,
PSEB, Patiala.

To

Mr. Satinder P.Gupta,
By Courier M/S Bharat Heavy Electricals Limited,
Power Sector, Project Engineering Management,
BHEL House, Siri Fort, New Delhi-110 049.

Memo No.GHTP/M-III/792/ 4145
Dated:- 17.3.05

Subject:- Design Memorandum & Flow Diagrams for Raw Water & CW Chlorination Plant and absorption System .

Dear Sir,

Please refer to MOM dated 2/3-03-05 between PSEB and BHEL held at Chennai. Enclosed please find herewith the following documents (in duplicate) duly approved in action -2:-

S.No.	Document No.	Description
1.	PE-DC-226-174-A-001 (Rev-01)	Design Memorandum for Raw Water & CW Chlorination Plant and absorption system.
2.	PE-DG-226-174-A-001 (Rev-01)	Flow Diagram for Cooling water chlorination and Raw Water Chlorination.

Dy.Director/MD-III,
For CE/Th.(D), PSEB, Patiala.

CC:-1. Mr. N.Rajendra/Project Co-Ordinator,
M/S TCE Consulting Engineers,
73/1 St.Marks' Road, Bangalore – 560 001 – alongwith one set of above document.

2. Mr. K.K. Ayare/AGM,
M/S BHEL, Power Sector - Project Management,
15th Fl, H.T. House, 18-20 K.G. Marg, New Delhi – 110001.

PROJECT ENGINEERING MANAGEMENT

(MECHANICAL ENGINEERING DEPARTMENT)

DOCUMENT COVER SHEET

NAME OF CUSTOMER: / PROJECT		PUNJAB STATE ELECTRICITY BOARD, PATIALA 2 X 250 MW, GHTPS, LEHRA MOHABBAT (UNIT – 3 & 4)
OWNER'S CONSULTANT	:	TCE CONSULTING ENGINEERS LTD, BANGALORE
ENGINEERING SUB CONTRACTOR	:	FICHTNER Consulting Engineers (India) Pvt. Ltd., CHENNAI
JOB NO.	:	226
DOCUMENT NO.	:	PE-DC-226-174-A001
SYSTEM	:	MECHANICAL
TITLE	:	DESIGN MEMORANDUM FOR RW AND CW CHLORINATION PLANT AND ABSORPTION SYSTEM

01	31/12/04	REVISED AS PER PSEB / TCE COMMENTS	VG		MAN		GR	
00	30/11/04	FOR PSEB / TCE APPROVAL	VG	-sd-	MAN	-sd-	GR	-sd-
A	17/11/04	FOR APPROVAL	VG	-sd-	MAN	-sd-	GR	-sd-
REV.	DATE	DETAILS OF REVISION	INITIAL	SIGN	INITIAL	SIGN	INITIAL	SIGN
			Prepared		Checked		Approved	

Table of Contents

1.0 INTRODUCTION

This document covers Raw Water and CW Chlorination plant and absorption system description, design philosophy for various components of the system, design philosophy for control and operation system for 2 X 250 MW GHTPS, Stage II, Lehra Mohabat, Units # 3 and # 4.

2.0 GENERAL DESCRIPTION

Chlorine is dosed in water to remove organics present in the water and make the water suitable for its intended use.

2.1 Raw Water Chlorination:

Raw water chlorination is done in the cascade aerator collection launder. The system consists of Two (2) X 100% booster pumps, tonne containers, gas filters and chlorinators along with injection system.

Gas Chlorine is drawn from chlorine tonners through the filters regulator to the chlorinator. From here, the chlorine gas, under vacuum, is sucked through an ejector to mix with motive water for delivery to point of dosage. Chlorine Booster pumps provide motive water. Chlorine booster pumps take their suction from the delivery tapping of raw water pumps to Cascade aerator. The chlorinator meters the amount of chlorine into the ejector and therefore to the point of use.

Raw Water Chlorination is done as continuous dosing at 10 ppm in the collection launder of cascade aerator. Two streams (2 X 100%) of 21 Kg/Hr chlorinators shall be provided for this purpose.

2.2 CW Chlorination:

Chlorine is also dosed in **Circulating Water system**. The dosing is done at the pumps suction in CW forebay. A separate system is provided for CW chlorination. The CW Chlorination system consists of Chlorine tonners, Gas Filters, Evaporators, safety relief valve, Chlorinator, injector and booster pumps. In CW chlorination system, the booster pumps draw water from the delivery header of CW pumps and deliver to the forebay (Near CW pumps suction) through ejectors. A platform weigh scale with trunions shall be provided as weighing arrangment for chlorine tonners.

CW Chlorination will be done as shock dosing at 5 ppm for 30 minutes every 8 hours. The dosing is done close to CW pumps suction to ensure most of the chlorine is carried to the condenser for disinfecting.

Two streams of 180 Kg/Hr (1W + 1 S) chlorinators each are provided for CW Chlorination.

For handling chlorine tonners for CW system, the system will consist of monorail and electrically operated hoist of 3.0 MT capacity and a tonner-lifting bar of 2 MT capacity.

2.3 POTABLE WATER CHLORINATION:

Potable water is being provided by PSEB near the boiler. The same shall be chlorinated by means of Hypochlorite dosing in the Potable water tank of 25 m3 capacity that is provided for stage II on the Deaerator floor. A dosing tank with 2 X 100% dosing pumps are provided for this purpose.

3.0 CHLORINE LEAK ABSORPTION SYSTEM

Chlorine leak absorption system is provided for the CW Chlorination system.

The system is designed to absorb 1 ton of chlorine in case of chlorine leak. In case of chlorine leakage, the gas is sucked from the FRP hood by blower and sent to absorption tower. Here, the chlorine is absorbed by sodium hydroxide (NaOH) filled in the caustic tank that is circulated by means of pump.

The system consists of FRP Hood, Blowers, Absorption tower, Caustic storage tank and circulating pumps. Leak detectors with multi probe will be provided in the tonner room and chlorinator room.

4.0 SIZING

4.1 Raw Water Chlorination:

a)	Raw Water Flow Rate	:	1987.4 M^3/Hr (However, the chlorinator is sized for maximum flow of 2100 m3/hr)
b)	Chlorine Dosage	:	10 ppm
c)	No. of Tonners	:	8 Nos

4.2 CW Chlorination:

a)	CW and ACW Flow Rate	:	35450 M^3/Hr
b)	Chlorine Dosage	:	5 ppm (Shock dosing)
c)	No. of Tonners	:	18 Nos

4.3 Potable Water Chlorination:

Potable water Tank Capacity	:	25 M^3
Chlorine dosage	:	2 ppm (Max)
Available Chlorine in Hypochlorite	:	6 %

4.4 Pipe sizing:

Pumps Suction	:	1.8 m/sec (max)
Pump discharge	:	2.5 m/sec (max)

5.0 MATERIAL OF CONSTRUCTION FOR PIPES AND VALVES

5.1	Pipes for waterlines	:	IS 1239 / IS 3589
5.2	Connecting tube from Tonner	:	Annealed Copper tested to 40 Kg/Cm^2

5.3	Pressure lines of chlorine	:	ASTM A 106 Gr B
5.4	Fittings / Flanges	:	ASTM A 105
5.5	Chlorine line valves (Except tonner valves)	:	ASTM A 105
5.6	Chlorine solution lines	:	CS with 3 mm thick Rubber Lined
5.7	Diffusers	:	HDPE
5.8	Valves on solution line	:	Cl Rubber lined.
5.9	Chlorine gas vacuum lines	:	PVC

6.0 CONTROL PHILOSOPHY

The operation of both raw water and CW Chlorination system will be manual. However, necessary interlocks will be provided for the safety of the system.

A local control panel shall be provided in the chlorination Plant separately for RW Chlorination system and CW chlorination system.

The panel will have the ON / OFF push buttons and status feedback for various drives in the chlorination Plant.

Alarm annunciation with hooter for pump trip, Chlorine leak detection etc hardwired with required number of windows shall be povided.

Local instruments like pressure gauges and temperature gauges shall be provided.

A portable residual chlorine analyser shall be provided.

7.0 SPECIFICATIONS OF MAJOR EQUIPMENT

7.1 CHLORINE TONNER

	Capacity	:	930 Kgs
	Quantity	:	Suitable for 30 days storage for CW Chlorination and 15 days storage for RW Chlorination
	MOC	:	ASTM A285Gr.C /ASTMA 516Gr. 60
	Approvals	:	As prescribed by Chief Controller Of Explosives, Govt of India

7.2 EVAPORATOR (For CW Chlorination Only)

	Type	:	Electrically heated water bath
	Capacity	:	120% min
	Quantity	:	2 X 100%
	Vaporizer Body	:	Seamless, ASTM A 106 Gr B

	Corrosion allowance	:	3 mm
	Radiography	:	100%
	Design code	:	IS 2825 or ASME Sec VII Div 1
	Heating element	:	Electrical immersion type, 3 phase 415 V AC.

7.3 CHLORINATOR:

	Capacity	:	180 KG / Hr for CW Chlorination) 21 Kg/Hr for RW Chlorination
	Quantity	:	2 X 100% (RW Chlorinator) 2 X 100% (CW Chlorinator)
	Chlorine Feed control	:	Manual adjuster
	Injector	:	One per chlorinator, CIRL
	Cabinet	:	Fiber Glass

7.4 BOOSTER PUMPS (For both RW and CW Chlorination)

	Quantity	:	2 X 100 % (For RW Chlorination) 2 X 100 % (For CW Chlorination)
	Type	:	Horizontal Centrifugal
	Casing	:	CI to IS 210 Gr FG 260
	Impeller	:	SS 304
	Design Code	:	IS 1520 withdrawn

7.5 SAFETY AND SUPERVISORY EQUIPMENT (Common)

	Weather Cock	:	1 No.
	Safety Shower	:	2 nos
	Ammonia Torch	:	4 Sets
	Emergency repair kit	:	1 set
	Oxygen breathing apparatus	:	4 sets
	Chlorine leak detectors	:	As Required for Plant
	Apron	:	4 Sets
	Chlorine Gas Mask	:	2 Sets

	Safety Shower with Eye wash fountain	:	One each for RW and CW Chlorination

7.6 HYPOCHLORITE DOSING SYSTEM

	Hypochlorite Dosing Tank	:	50 Litres capacity non metallic
	Hypochlorite dosing Pumps	:	Diaphragm Type, single phase, Polypropylene, 0 to 2 LPH capacity

7.7 CHLORINE LEAK ABSORPTION SYSTEM (For CW System Chlorination Only)

	Type	:	Counter Current with packing
	Capacity	:	One tonner of chlorine
	Qty / Caustic Re circulation tank	:	1 no, / IS 2062 Rubber Lined.
	Blowers	:	2 X 100%, Centrifugal, FRP Lined
	Absorbent	:	Sodium Hydroxide (NaOH)
	Caustic Re circulation Pump	:	Horizontal, centrifugal, FRP or Rubber Lined suitable to handle NaOH, NaOCl and NaCl.
	Chlorine Duct	:	PP + FRP

8.0 CODES AND STANDARDS

The Chlorination system shall be designed, manufactured and installed in line with the applicable standards for the system.

8.1	Chlorination system	:	Chlorine Institute Standard + IS 10553 Part 1 & 2
8.2	Power Piping	:	ASME B 31.1
8.3	Flanges	:	ANSI B 16.5
8.4	FRP Tanks	:	BS 4994
8.5	Tanks of Carbon Steel	:	IS 803
8.6	Rubberlining	:	IS 4682 Part 1
8.7	Ball Valve	:	BS 5351
8.8	Butterfly Valve	:	BS 5155

SECTION – D2
GENERAL TECHNICAL REQUIREMENT FOR ELECTRICAL

1.0 INTENT OF SPECIFIATION

The specification covers the design, materials, constructional features, manufacture, inspection and testing at manufacturer's work, and packing of Low voltage (LV) squirrel cage induction motors along with all accessories for driving auxiliaries in thermal power station.

Motors having a voltage rating of below 1000V are referred to as low voltage (LV) motors.

2.0 CODES AND STANDARDS

Motors shall fully comply with latest edition, including all amendments and revision, of following codes and standards:

IS:325	Three phase Induction motors
IS : 900	Code of practice for installation and maintenance of induction motors
IS: 996	Single phase small AC and universal motors
IS: 4722	Rotating Electrical machines
IS: 4691	Degree of Protection provided by enclosures for rotating electrical machines
IS: 4728	Terminal marking and direction of rotation rotating electrical machines
IS: 1231	Dimensions of three phase foot mounted induction motors
IS: 8789	Values of performance characteristics for three phase induction motors
IS: 13555	Guide for selection and application of 3-phase A.C. induction motors for different types of driven equipment
IS: 2148	Flame proof enclosures for electrical appliance
IS: 5571	Guide for selection of electrical equipment for hazardous areas
IS: 12824	Type of duty and classes of rating assigned
IS: 12802	Temperature rise measurement ofr rotating electrical machnines
IS: 12065	Permissible limits of noise level for rotating electrical machines
IS: 12075	Mechnical vibration of rotatinf electrical machines

In case of imported motors, motors as per IEC-34 shall also be acceptable.

3.0 DESIGN REQUIREMENTS

3.1 Motors and accessories shall be designed to operate satisfactorily under conditions specified in data sheet-A and Project Information, including voltage & frequency variation of supply system as defined in Data sheet-A

3.2 Motors shall be continuously rated at the design ambient temperature specified in Data Sheet-A and other site conditions specified under Project Information
Motor ratings shall have at least a 15% margin over the continuous maximum demand of the driven equipment, under entire operating range including voltage & frequency variation specified above.

3.3 Starting Requirements

3.3.1 Motor characteristics such as speed, starting torque, break away torque and starting time shall be properly co-ordinated with the requirements of driven equipment. The accelerating torque at any speed with the minimum starting voltage shall be at least 10% higher than that of the driven equipment.

3.3.2 Motors shall be capable of starting and accelerating the load with direct on line starting without exceeding acceptable winding temperature.

The limiting value of voltage at rated frequency under which a motor will successfully start and accelerate to rated speed with load shall be taken to be a constant value as per Data Sheet - A during the starting period of motors.

3.3.3 The following frequency of starts shall apply

i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.

ii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature. (not to be repeated in the second successive hour)

iii) Motors for coal conveyor and coal crusher application shall be suitable fro three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be sutable fro mimimum 20,000 starts during the life time of the motor

3.4 **Running Requirements**

3.4.1 Motors shall run satisfactorily at a supply voltage of 75% of rated voltage for 5 minutes with full load without injurious heating to the motor.

3.4.2 Motor shall not stall due to voltage dip in the system causing momentary drop in voltage upto 70% of the rated voltage for duration of 2 secs.

3.5 **Stress During bus Transfer**

3.5.1 Motors shall withstand the voltage, heavy inrush transient current, mechnical and torque stress developed due to the application of 150% of the rated voltage for at least 1 sec. caused due to vector difference between the motor residual voltage and the incoming supply voltage during occasional auto bus transfer.

3.5.2 Motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.

3.6 Maximum noise level measured at distance of 1.5 metres from the outline of motor shall not exceed85dB. Peak amplitude of vibrations shall be within IS specified limits.

3.7 The max. vibration velocity or double amplitude of motors vibration as measured at motor bearings shall be within the limits specified in IS: 12075.

4.0 **CONSTRUCTIONAL FEATURES**

4.1 All motor enclosure shall conform to DOP-IP55 unless otherwise specified. Motor for outdoor or semi-outdoor service shall be weather proof construction.

4.2 Motors upto 160KW shall have Totally Enclosed Fan Cooled (TEFC) enclosures, the method of cooling conforming to IC-0141 or IC-0151 of IS: 6362.

Motors rated above 160 KW shall be Closed Air Circuit Air (CACA) cooled

4.3 Motors shall be designed with cooling fans suitable for both directions of rotation.

4.4. Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors.

4.5 Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point.

4.6 In case Class 'F' insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class 'B' insulation.
In case of continuous operation at extreme voltage limits the temperature limits specified in table-1 of IS:325 shall not exceed by more than 10°C.

4.7 **Terminals and Terminal Boxes**

4.7.1 Terminals, terminal leads, terminal boxes, windings tails and associated equipment shall be suitable for connection to a supply system having a short circuit level, specified in the Data Sheet-A.

Unless otherwise statedin Data Sheet-A, motors rated above 100kW shall be breaker controlled. For motors rated higher than 110kW , breaker shall be given with motor protection relay. The terminal box of motors shall be designed for the fault current mentioned in data sheet "A".

4.7.2 Unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end.

4.7.3 Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or V W & V respectively.

4.7.4 Permanently attached diagram and instruction plate made preferably of stainless steel shall be mounted inside terminal box cover giving the connection diagram for the desired direction of rotation and reverse rotation.

4.7.5 Motor terminals and terminal leads shall be fully insulated with no bar live parts. Adequate space shall be available inside the terminal box so that no difficulty is encountered for terminating the cable specified in Data Sheet-A.

4.7.6 Degree of protection for terminal boxes shall be IP 55 as per IS 4691.

4.7.7 Separate terminal boxes shall be provided for space heaters.. If this is not possible in case of LV motors, the space heater terminals shall be adequately segregated from the main terminals in the main terminal box. Detachable gland plates with double compression brass glands shall be provided in terminal boxes.

4.7.8. Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors. Terminal box shall be capable of withstanding maximum system fault current for duration of 0.25 sec.

4.7.9 Cable glands and cable lugs as per cable sizes specified in Data Sheet-A shall be included. Cable lugs shall be of tinned Copper, crimping type & double compression brass glands to match cable used.

4.8 Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor of size given below shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal.

Motors above 90kW : 50X6mm GS flat
Motors above 30kW upto 90 kW : 35 X 6mm GS flat
Motor above 5kW upto 30kW : 25 X 3 mm GS flat
Motor upto 5 kW : 8 SWG GI wire

4.9 **General**

4.9.1 Motors provided for similar drives shall be interchangeable.

4.9.2 Suitable foundation bolts are to be supplied alongwith the motors.

4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 25Kgs. and above.

4.9.4 Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956.

4.9.5 All motors rated 30 kW and above shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz.

4.9.6 Name plate with all particulars as per IS: 325 shall be provided

4.9.7 Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions.

5.0 **INSPECTION AND TESTING**

5.1 All materials, components and equipments covered under this specification shall be procured, manufactured, as per the BHEL standard quality plan No. PED-506-00-Q-006/0 and PED-506-00-Q-007/2 enclosed with this specification and which shall be complied.

5.2 LV motors of type-tested design shall be provided. Valid type test reports not more than 5 year shall be furnished. In the absence of these, type tests shall have to be conducted by manufacturer without any commercial implication to purchaser.

5.3 All motors shall be subjected to routine tests as per IS: 325 and as per BHEL standard quality plan.

5.4 Motors shall also be subjected to additional tests, if any, as mentioned in Data Sheet A.

6.0 **DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT**

a) OGA drawing showing the position of terminal boxes, earthing connections etc.
b) Arrangement drawing of terminal boxes.
c) Characteristic curves:
(*To be given for motor above 55 kW unless otherwise specified in Data Sheet*).

i) Current vs. time at rated voltage and minimum starting voltage.
ii) Speed vs. time at rated voltage and minimum starting voltage.
iii) Torque vs. speed at rated voltage and minimum voltage.
For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling.
iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.

LT POWER CABLES

1.00.00 **CODES & STANDARDS**

1.01.00 All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS : codes, standards, etc.) referred to herein, the former shall prevail. All the cables shall conform to the requirements of the following standards and codes:

IS :1554 - I	PVC insulated (heavy duty) electric cables for working voltages upto and including 1100V.
IS : 3961	Recommended current ratings for cables
IS : 3975	Low carbon galvanised steel wires, formed wires and tapes for armouring of cables.
IS : 4905	Methods for random sampling.
IS : 5831	PVC insulation and sheath of electrical cables.
IS : 7098 (Part -I)	Cross linked polyethylene insulated PVC sheathed cables for working voltages upto and including 1100V.
IS : 8130	Conductors for insulated electrical cables and flexible cords.
IS : 10418	Specification for drums for electric cables.
IS : 10810	Methods of tests for cables.
ASTM - D - 2843	Standard test method for density of smoke from the burning or decomposition of plastics.
IEC - 754 (Part-I)	Test on gases evolved during combustion of electric cables.
IEC - 332	Tests on Electric cables under fire conditions. Part-3 : Tests on bunched wires or cables (catagory -B)

2.00.00	**TECHNICAL REQUIREMENTS**
2.01.00	The cables shall be suitable for laying on racks, in ducts, trenches, conduits and under ground burried installation with chances of flooding by water.
2.02.00	Cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses develop under steady state and transient operating conditions as specified elsewhere in this specification.
2.03.00	Aluminium conductor used in power cables shall have tensile strength of more than 100 N/ sq.mm. Conductors shall be multi stranded.
2.04.00	XLPE insulation shall be suitable for a continuous conductor temperature of 90^{O}C and short circuit conductor temperature of 250 deg. C. PVC insulation shall be suitable for continuous conductor temperature of 70 deg.C and short circuit conductor temperature of 160 deg. C.
2.05.00	The cable cores shall be laid up with fillers between the cores wherever necessary. It shall not stick to insulation and inner sheath. All the cables, other than single core unarmoured cables, shall have distinct extruded PVC inner sheath of black colour as per IS : 5831.
2.06.00	For single core armoured cables, armouring shall be of aluminium wires. For multicore armoured cables armouring shall be of galvanised steel as follows:-

	Calculated nominal dia of cable under armour	**Size and Type of armour**
i)	Upto 13 mm	1.4mm dia GS wire
ii)	Above 13 & upto 25mm	0.8 mm thick GS formed wire / 1.6 mm dia GS wire
iii)	Above 25 & upto 40 mm	0.8mm thick GS formed wire / 2.0mm dia GS wire
iv)	Above 40 & upto 55mm	1.4 mm thick GS formed wire / 2.5mm dia GS wire
v)	Above 55 & upto 70 mm	1.4mm thick GS formed wire / 3.15mm dia GS wire
vi)	Above 70mm	1.4 mm thick GS formed wire / 4.0 mm dia GS wire

2.06.01	The aluminium used for armouring shall be of H_4 grade as per IS:8130 with maximum resistivity of 0.028264 omhs mm^2 per metre at 20^oC. Aluminium armouring shall be same as indicated above for galvanolised steel.
2.06.02	The gap between armour wire / formed wire shall not exceed one armour wire / formed wire space and there shall be no cross over / over-riding of armour wire / formed wire. The minimum area of coverage of armouring shall be 90%. The breaking load of armour joint shall not be less than 95% of that of armour wire / formed wire. Zinc rich paint shall be applied on armour joint surface.
2.07.00	Outer sheath shall be of PVC(of suitable grade) & black in colour. In addition to meeting all the requirements of Indian standards referred to, outer sheath of all the cables shall have the following FRLS properties. (a) Oxygen index of min. 29 (As per IS:10810 (part-58)) (b) Acid gas emission of max. 20% (As per IEC-754-I). (c) Smoke density rating shall not be more than 60% during Smoke Density Test as per ASTMD-2843.
2.08.00	Cores of the cables shall be identified by colouring of insulation. Following colour scheme shall be adopted: 1 core - Red, Black, Yellow, Blue 2 core - Red & Black 3 core - Red, Yellow & Blue 4 core - Red, Yellow, Blue and Black
2.09.00	For reduced neutral conductors the core shall be black.
2.10.00	In addition to manufacturer's identification on cables as per IS, following marking shall also be provided over outer sheath. 1) Cable size and voltage grade - To be embossed 2) Word 'FRLS' at every 5 metre - To be embossed 3) Sequential marking of length of the cable in metres at every one metre.- To be embossed / printed

	The embossing shall be progressive, automatic, in line and marking shall be legible and indelible.
2.11.00	All cables shall meet the fire resistance requirement as per Category-B of IEC 332 Part-3.
2.12.00	Allowable tolerances on the overall diameter of the cables shall be +\-2 mm maximum over the declared value in the technical data sheets.
2.13.00	In plant repairs to the cables shall not be accepted. Pimples, fish eye, blow holes etc.are not acceptable.
2.14.00	**Cable selection & sizing**
2.14.01	LT Power cables shall be sized based on the following considerations: (a) Rated current of the equipment (b) The voltage drop in the cable, during motor starting condition, shall be limited to 10% and during full load running condition, shall be limited to 3% of the rated voltage (c) Short circuit withstand capability This will depend on the feeder type. For a fuse protected circuit, cable should be sized to withstand the let out energy of the fuse.For breaker controlled feeder, cable shall be capable of withstanding the system fault current level for total breaker tripping time inclusive of relay pickup time. (d) The minimum conductor size shall be 6 sqmm for aluminium conductor cables and 2.5 sqmm for copper conductor cables. The constructional details of copper conductor cables shall be same as indicated for copper control cable.
2.14.02	Derating Factors Derating factors for various conditions of installations including the following shall be considered while selecting the cable sizes: a) Variation in ambient temperature for cables laid in air b) Grouping of cables c) Variation in ground temperature and soil resistivity for buried cables.

2.14.03	Cable lengths shall be considered in such a way that straight through cable joints are avoided.
2.14.04	Cables shall be armoured type if laid in switchyard area or directly buried.
2.14.05	All LT power cables of sizes more than 120 sq.mm. shall be XLPE insulated and preferable sizes are 1Cx150, 1Cx300, 1Cx630, 3Cx150 & 3Cx240 sq.mm.
3.00.00	**CONSTRUCTIONAL FEATURES**
3.01.00	**1.1 KV Grade Power Cables** (a) 1.1 KV grade XLPE power cables shall have compacted aluminium conductor, XLPE insulated, PVC inner-sheathed (as applicable), armoured/ unarmoured, PVC outer-sheathed conforming to IS:7098. (Part-I). (b) 1.1KV grade PVC power cables shall have aluminium conductor(compacted type for sizes above 10 sq.mm), PVC Insulated, PVC inner sheathed (as applicable) armoured/ unarmoured, PVC outer-sheathed conforming to IS:1554 (Part-I). (c) 1.1 KV grade Trailing cables shall have tinned copper(class 5)conductor, insulated with heat resistant elastomeric compound based on Ethylene Propyline Rubber(EPR) suitable for withstanding 90 deg.C continuous conductor temperature and 250 deg. C during short circuit, inner-sheathed with heat resistant elastomeric compound, nylon cord reinforced, outer-sheathed with heat resistant, oil resistant and flame retardant heavy duty elastomeric compound conforming to IS 9968.
3.02.00	**Cable Drums** (a) Cables shall be supplied in non returnable wooden or steel drums of heavy construction. The surface of the drum and the outer most cable layer shall be covered with water proof layer. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by 'U' nails so as to eliminate ingress of water during transportation, storage and erection. Wood preservative anti-termite treatment shall be applied to the entire drum. Wooden drums shall comply with IS : 10418. (b) Each drum shall carry manufacturer's name, purchaser's name, address and contract number, item number and type, size and length of cable and net gross weight stencilled on both sides of the drum. A tag containing same information shall be attached to the leading end of the cable. An arrow and suitable accompanying wording shall be

marked on one end of the reel indicating the direction in which it should be rolled.

4.00.00 TESTS

4.01.00 **GENERAL**

1.0 All equipments to be supplied shall be of type tested quality. The Contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last five years from the date of bid opening. These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

2.0 In case the Contractor is not able to submit report of the type test(s) conducted within last five years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the Contractor shall conduct all such tests under this contract free of cost to the Owner and submit the reports for approval.

3.0 All acceptance and routine tests as specified below and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

4.02.00 **TYPE TESTS:**

4.02.01 The type tests reports for the following shall be submitted on one size each of PVC / XLPE LT Power cables of each make:

S. No.	Type Test	Remarks
a)	For Conductor	
	1. Resistance test	
b)	**For Armour Wires / Formed wires**	
	1. Measurement of Dimensions	
	2. Tensile Test	For aluminium wires also
	3. Elongation test	For aluminium wires also
	4. Torsion test	For round wires only

	5.	Winding test	For Formed wires only
	6.	Resistance test	For aluminium wires also
	7.	Zinc Coating test	For G.S. Formed wires /wires only.
c)	**For PVC/XLPE insulation & PVC Sheath**		
	1.	Test for thickness	
	2.	Tensile strength & elongation tests before ageing and after ageing	
	3.	Ageing in air oven	
	4.	Loss of mass test	For PVC insulation and sheath only
	5.	Hot deformation test	For PVC insulation and sheath only
	6.	Heat shock test	For PVC insulation and sheath only
	7.	Shrinkage test	
	8.	Thermal stability test	For PVC insulation and sheath only
	9.	Hot set test	For XLPE insulation only
	10.	Water absorption test	For XLPE insulation only
	11.	Oxygen index test	For outer sheath only
	12.	Smoke density test	For outer sheath only
	13.	Acid gas generation test	For outer sheath only
d)	**For completed cables**		
	1.	Insulation resistance test (Volume resistivity method)	
	2.	High voltage test	
	3.	Flammability test as per IEC - 332 Part-3 (Category -B)	
4.02.02	**Acceptance Tests** (as per QA table)		
4.03.00	**Routine Tests** (as per QA table)		

LT CONTROL CABLES

1.00.00 CODES & STANDARDS

1.01.00 All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS : codes, standards, etc.) referred to herein, the former shall prevail. All the cables shall conform to the requirements of the following standards and codes :

IS :1554 - I	PVC insulated (heavy duty) electric cables for working voltages upto and including 1100V.
IS : 3961	Recommended current ratings for cables
IS : 3975	Low carbon galvanised steel wires, formed wire and tapes for armouring of cables.
IS : 4905	Methods for random sampling.
IS : 5831	PVC insulation and sheath of electrical cables.
IS : 8130	Conductors for insulated electrical cables and flexible cords.
IS : 10418	Specification for drums for electric cables.
IS : 10810	Methods of tests for cables.
ASTM-D -2843	Standard test method for density of smoke from the burning or decomposition of plastics.
IEC-754 (Part-I)	Test on gases evolved during combustion of electric cables.
IEC -332	Tests on Electric cables under fire conditions Part-3 : Tests on bunched wires or cables (category -B)

2.00.00 TECHNICAL REQUIREMENTS

2.01.00 The cables shall be suitable for laying on racks, in ducts, trenches, conduits and under ground burried installation with chances of flooding by water.

2.02.00	Cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses develop under steady state and transient operating conditions as specified elsewhere in this specification.
2.03.00	Conductor of control cables shall be made of multi stranded, plain annealed copper.
2.04.00	PVC insulation shall be suitable for continuous conductor temperature of 70 deg C and short circuit conductor temperature of 160 deg. C.
2.05.00	The cable cores shall be laid up with fillers between the cores wherever necessary. It shall not stick to insulation and inner sheath. All the cables, other than single core unarmoured cables, shall have distinct extruded PVC inner sheath of black colour as per IS : 5831.
2.06.00	For multicore armoured cables, the armouring shall be of galvanised steel as follows :-

Calculated nominal dia of cable under armour	**Size and Type of armour**
1) Upto 13 mm	1.4mm dia GS wire
2) Above 13 upto 25 mm	0.8 mm thick GS formed wire / 1.6 mm dia GS wire
3) Above 25 upto 40 mm	0.8mm thick GS formed wire / 2.0mm dia GS wire
4) Above 40 upto 55mm	1.4 mm thick GS formed wire/ 2.5mm dia GS wire
5) Above 55 upto 70 mm	1.4mm thick GS formed wire / 3.15mm dia GS wire
6) Above 70mm	1.4 mm thick GS formed wire / 4.0 mm dia GS wire

The gap between armour wire / formed wire shall not exceed one armour wire / formed wire space and there shall be no cross over / over-riding of armour wire / formed wire. The minimum area of coverage of armouring shall be 90%. The breaking load of armour joint shall not be less than 95% of that of armour wire / formed wire. Zinc rich paint shall be applied on armour joint surface.

2.07.00	Outer sheath shall be of PVC (grade as applicable) and grey in colour. In addition to meeting all the requirements of Indian standards referred to, outer sheath of all the cables shall have the following FRLS properties. (a) Oxygen index of min. 29 (As per IS:10810 (part-58)) (b) Acid gas emission of max. 20% (As per IEC-754-I). (c) Smoke density rating shall not be more than 60% during Smoke Density Test as per ASTMD-2843.
2.08.00	Cores of the cables of upto 5 cores shall be identified by colouring of insulation. Following colour scheme shall be adopted. 1 core - Red, Black, Yellow or Blue 2 core - Red & Black 3 core - Red, Yellow & Blue 4 core - Red, Yellow, Blue and Black 5 core - Red, Yellow, Blue, Black and Grey
2.09.00	For cables having more than 5 cores, core identification shall be done by numbering the insulation of cores sequentially, starting by number 1 in the inner layer (e.g. say for 10 core cable, core numbering shall be from 1 to 10). The number shall be printed in Hindu-Arabic numerals on the outer surfaces of the cores. All the numbers shall be of the same colour, which shall contrast with the colour of insulation. The colour of insulation for all the cores shall be grey only. The numerals shall be legible and indelible. The numbers shall be repeated at regular intervals along the core, consecutive numbers being inverted in relation to each other. When the number is a single numeral, a dash shall be placed under neath it. If the number consists of two numerals, these shall be disposed one below the other and a dash placed below the lower numeral. The spacing between consecuture numbers shall not exceed 50 mm.
2.10.00	In addition to manufacturer's identification on cables as per IS, following marking shall also be provided over outer sheath : (a) Cable size and voltage grade - To be embossed

	(b) Word 'FRLS' at every 5 metre - To be embossed (c) Sequential marking of length of the cable in metres at every one metre. To be embossed / printed. The embossing / printing shall be progressive, automatic, in line and marking shall be legible and indelible.
2.11.00	All cables shall meet the fire resistance requirement as per Category-B of IEC 332 Part -3.
2.12.00	Allowable tolerances on the overall diameter of the cables shall be +\-2 mm maximum over the declared value in the technical data sheets.
2.13.00	In plant repairs to the cables shall not be accepted. Pimples, fish eye, blow holes etc. are not acceptable.
2.14.00	**Cable selection & sizing**
2.14.01	LT Control cables shall be sized based on the following considerations: (a) Rated current of the equipment (b) The voltage drop in the cable, during motor starting condition, shall be limited to 10% and during full load running condition, shall be limited to 3% of the rated voltage (c) Short circuit withstand capability This will depend on the feeder type. For a fuse protected circuit, cable should be sized to withstand the let out energy of the fuse.For breaker controlled feeder, cable shall be capable of withstanding the system fault current level for total breaker tripping time inclusive of relay pickup time. (d) The minimum size of conductor shall be 1.5 sqmm
2.14.02	Derating Factors Derating factors for various conditions of installations including the following shall be considered while selecting the cable sizes: a) Variation in ambient temperature for cables laid in air b) Grouping of cables c) Variation in ground temperature and soil resistivity for buried cables.

2.14.03	Cable lengths shall be considered in such a way that straight through cable joints are avoided.
2.14.04	Cables shall be armoured type if laid in switchyard area or directly buried.
3.00.00	**CONSTRUCTIONAL FEATURES**
3.01.00	**1.1 KV Grade Control Cables** Control Cables shall have stranded copper conductor multicore PVC insulated, PVC inner-sheathed, armoured / unarmoured, PVC outer-sheathed conforming to IS:1554. (Part-I).
3.02.00	**Cable Drums** (a) Cables shall be supplied in non returnable wooden or steel drums of heavy construction. The surface of the drum and the outer most cable layer shall be covered with water proof layer. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by 'U' nails so as to eliminate ingress of water during transportation, storage and erection. Wood preservative anti-termite treatment shall be applied to the entire drum. Wooden drums shall comply with IS : 10418. (b) Each drum shall carry manufacturer's name, purchaser's name, address and contract number, item number and type, size and length of cable and net gross weight stencilled on both the sides of the drum. A tag containing same information shall be attached to the leading end of the cable. An arrow and suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled.
4.00.00	**TESTS**
4.01.00	**GENERAL** 1.0 All equipments to be supplied shall be of type tested quality. The Contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last five years from the date of bid opening. These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

	2.0 In case the Contractor is not able to submit report of the type test(s) conducted within last five years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the Contractor shall conduct all such tests under this contract free of cost to the Owner and submit the reports for approval. 3.0 All acceptance and routine tests as specified below and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.
4.02.00	**TYPE TESTS:**
4.02.01	The Type tests reports for the following shall be submitted for one size each of LT control cable of each make : **S. No. Type Test** — **Remarks** a) **For Conductor** 1. Resistance test b) **For Armour Wires / Formed wires** 1. Measurement of Dimensions 2. Tensile Test 3. Elongation test 4. Torsion test — For round wire only 5. Winding test — For Formed wires 6. Resistance test 7. Zinc Coating test — For G.S. conductors only. c) **For PVC insulation & PVC Sheath** 1. Test for thickness 2. Tensile strength and elongation test before ageing and after ageing

	3.	Ageing in air oven	
	4.	Loss of mass test	For PVC insulation and sheath only
	5.	Hot deformation test	For PVC insulation and sheath only
	6.	Heat shock test	For PVC insulation and sheath only
	7.	Shrinkage test	
	8.	Thermal stability test	For PVC insulation and sheath only
	9.	Oxygen index test	For outer sheath only
	10.	Smoke density test	For outer sheath only
	11.	Acid gas generation test	For outer sheath only
	d)	**For completed cables**	
	1.	Insulation resistance test (Volume resistivity method)	
	2.	High voltage test	
	3.	Flammability test as per IEC - 332 Part-3 (Category-B)	
4.02.02	**Acceptance Tests** (as per QA table)		
4.03.00	**Routine Tests** (as per QA table)		

SECTION – D3
GENERAL TECHNICAL REQUIREMENT FOR C&I

1.0 SCOPE

This specification covers the Design, Manufacture, Inspection and Testing at the manufacturer's works, proper packing for transportation and delivery to site, supervision, erection, and commissioning at site of Local Panels required for control and monitoring of the Auxiliary Plant & Equipment.

2.0 CODES AND STANDARDS

2.1 All the equipments specified herein shall comply with the requirements of the latest issue of the relevant National and International standards.

2.2 As a minimum requirement, the following standards shall be complied with:

a) IS-6005 : 1998 : Code of practice for phosphating of iron and steel.
b) IS-5 : 2007 : Colors for ready mixed paints and enamels.
c) IS-1248:2003 : Direct Acting Indicating Analog Elec Measuring Instruments.
d) IS/IEC 60947:Part 1:2004 : Low Voltage switchgear & control gear: Part-I (General Rules)
e) IS-8828:1996 : Circuit breaker for household and similar installations.
f) IS-13947 (Part-I):1993 : Low Voltage switchgear & control gear : Part-I (General Rules)
g) ISA-18.1:1979 : Annunciator Sequences and Specification
h) NFPA-496:2003 : Purged & Pressurised Enclosure for Electrical Equipment in Hazardous Locations.

3.0 TECHNICAL REQUIREMENTS

3.1 Panel Construction

3.1.1 The local panels shall house the secondary instruments, annunciation system, Single loop controller, Control switches / push buttons, indicating lamps/LED cluster, relays, timers and other devices required for operation and monitoring of the equipment locally.

3.1.2 The panels shall be of free standing type either welded construction on angle iron (minimum section of 50 x 50 x 4 mm) structure or folded construction by sheet metal formation depending upon the equipments to be mounted on it. The panels shall be robustly built and stiffeners as necessary shall be provided.

3.1.3 The panel shall be suitably reinforced to ensure adequate support for all instruments mounted thereon. All welds on exposed panel surfaces shall be ground smooth.

3.1.4 The salient features of construction shall be:

Sheet material: Cold rolled sheet steel
Frame thickness: Not less than 3.0mm
Enclosure thickness: Not less than 2.5 mm for load bearing sections (Mounted with instruments)
1.6 mm for doors and Not less than 2.0 mm for others
Panel Height: Not less than 2365 mm
Gland plate thickness: 3.0mm
Base channel: ISMC 100 with anti-vibration mounting & foundation bolts.

3.1.5 The panel shall be provided with rear doors with integral lockable handle. The door when locked shall be held at minimum three places. The door width shall not be more than 550mm.The doors shall be provided with suitable stiffeners to prevent buckling. The handle shall be on the right side of the door. The door shall be removable type with concealed hinges to facilitate maintenance work. Suitable pocket inside the door shall be provided for keeping the drawings / documents. Double door shall be provided with suitable glass windows, as per the requirement.

3.1.6 Suitable neoprene gasket shall be provided on all doors and removable covers. Suitable ventilation system along with louvers shall be provided at bottom and top of the doors covered with removable wire mesh.

3.1.7 The class of protection shall be in accordance with IP-55 unless otherwise specified .

3.1.8 All steel surfaces shall be cleaned by sand / pellet blasting, treated for pickling, degreasing and phosphating etc. by seven tank method. The panel shall have a high quality finish and appearance. The panel shall be painted with two coats of primer followed by two coats of epoxy / synthetic enamel based final paint of color shade and finish as specified in the attached data sheet. Minimum thickness of the paint shall be 85 microns for external paint and 70 microns for internal paint.

3.1.9 The cable glands of the required size and type shall be supplied along with the Panel. Panel shall have gland plate at cable entry to panel.Thickness of gland plate shall not be less than 3mm.

3.1.10 All operable and indicating devices shall be mounted on the front of the panel while aux. Relays / timers MCBs etc. required for realization of control logics shall be mounted on a mounting plate inside the panel. Auxiliary relays and timers etc. shall be grouped according to the control function.

No operable or indicating devices shall be mounted below 750 mm and above 1800 mm (w.r.t. finished ground level). The devices shall be located in such a way so as to ensure easy access for operation / maintenance.

3.1.11 Dual control power supply feeders of voltage class as specified in data sheet-A (No. PES-145A-DS1-0) shall be provided by the purchaser. In case redundant power supply feeders are provided then auto changeover unit shall be mounted on the panel are in the panel supplier's scope. Alaram shall be provided against failure of a single power supply. Where DC control power supply is specified an additional 240V, 50 Hz AC supply feeder for powering of space heater and lighting shall be provided by the purchaser. Suitable arrangement shall be provided inside the panel to receive and terminate the power supply feeder(s). For this purpose MCBs of suitable current rating shall be provided by the vendor. A supervisory relay along with a pilot lamp to indicate control supply 'ON' shall be provided on the panel. Any other power supply required for the operation of the devices mounted in the panel shall be arranged by the vendor.

3.1.12 The internal wiring shall be carried out with 1100 volt grade PVC insulated copper multi strand wire / flexible of 1.5mm2 size. AC & DC wires shall be kept separate from each other. Separate coloured wires to be used for AC and DC circuits. All wires shall be properly numbered and identified with ferrules as per the Control scheme / wiring diagram. Wires shall be routed and run through PVC troughs/tray.

3.1.13 Terminal blocks shall be clip on type, 1100 volts grade. Separate terminal blocks shall be used for AC & DC circuits. The terminals shall be suitable for terminating 0.5 mm2 to 2.5mm2 external cables. The TB points in terminal block shall be cage clamp type / screw type. The terminal for ammeters shall be provided with removable links for shorting CTs. Each terminal strip shall be provided with identification strip. The terminal shall not be mounted below 250 mm height from finished floor. The panel shall have ten (20) percent spare terminal.

3.1.14 The interior of each panel shall be suitably illuminated through fluorescent lamps / tube lights with shrouded cover of minimum 15W operable on 240V 50 Hz AC power supply through panel door switch. A 5 Amp. 3-pin Power receptacle with plug shall be provided.

3.1.15 Suitable space heaters operable on 240 Volts 50 Hz AC power system with ON-OFF switch shall be provided at the panel bottom. These shall be designed to maintain the panel temperature five (5) deg. C above the ambient temperature during maintenance shutdown. Suitable isolating and control devices comprising of MCB, thermostat etc. shall be provided for the space heater.

3.1.16 The panel shall be provided with a copper earth bus of 25 x 6 mm size running throughout the width of the panel. It shall be terminated internally with 10 mm bolts at extreme ends for connection to; main station earth. The panel mounted equipments / devices shall be connected to earth bus through green coloured PVC insulated stranded copper conductor of 2.5 mm2 size.

3.1.17 Local Panel shall be provided with main name plate of 150 mm x 40 mm size having inscription of 20 mm height. The individual devices on the panels shall be as provided with separate name plate with inscription of 3 mm height. The instrument / devices shall be provided with stick on label plates inside the panel. The material of the main and individual labels shall be three (3) ply 3 mm thick Traffolyte Sheet / 2 mm Anodised Aluminium Plate. The material shall be laminated phenolic, The inscription shall

be with white letters on black background on traffolyte sheet. The labels shall be fixed by self tapping non-rusting screws. The nameplates for panels /consoles shall be provided both on the front and the rear.

3.1.18 Vendor shall furnish electric load and heat load list (in case panel is to be placed in ac environment) of each panel.

3.2 Hazardous Area Panel Requirement

3.2.1 The Local Panel located in hazardous area shall be pressurized as per NFPA-496 requirements to render it non-hazardous. Alarms shall be provided for local and remote annunciation when pressurisation falls below 2.5 mm of water column. Protection shall be of type Z of NFPA-496. It shall not be possible to switch ON the power of purged section unless it is purged as per the recommendation of NFPA-496. Vendor must provide a protective device on the panel to protect the panel from over pressurisation.

3.2.2 Vendor shall supply pressurisation kit consisting of valves, restriction orifices, dual filter regulation, pressure gauges, pressure switches, rotameter etc. Pressurisation kit shall be surface mounting on a metal board and located outside the local panel. Pressurisation kit shall further consist of solenoid valve flow switch, timer blow off safety device etc., so as to make purging fully automatic. However final start shall be manual. Panel protection against over pressure to be provided as per NFPA-496.

3.2.3 Pressurised local control panel pressurization kit assembly design shall provide minimum leakage flow through the Local Control Panel. Panel venting shall be as per NFPA-496.

3.2.4 All components in the local panel like indicating instruments, push buttons switches, lamps etc., which are required to be energized without panel pressurization or before completion of purge cycle shall be explosion proof as per NEMA-7 & suitable for area classification.

3.2.5 All push buttons etc. requiring frequent operation during machine running shall have good positive sealing. Weatherproof housing or cover to be provided wherever necessary. Vendor shall provide pressurisation bypass switch outside explosion proof enclosure of pressurized panel with lamp indication. This shall be used only during maintenance. All hinges, screws, other non-painted metallic parts shall be of stainless steel material.

3.2.6 Provision to switch off manually all types of power shall be provided in the panel. In addition, it shall also be possible to switch off power circuits / components which are powered from motor control centre or control room manually in case of pressurization failure. All such cables from MCC and main control room shall be terminated in explosion proof boxes (NEMA-7).

3.3 Control & Monitoring devices

3.3.1 Instruments like Indicators, recorders, single loop controllers etc. as applicable and specified elsewhere for the plant / equipment shall be supplied and mounted on the panel.

3.3.2 Alarm Annunciator System

It shall be solid state discrete facia type having a sequence of ISA-S18.1A or as specified, opaque facia windows of 70 mm x 50 mm size, having two (2) lamps per window, and hooter of 10W, and provision for repeat group alarm at remote. The annunciator shall be provided with ten (10) percent spare windows or minimum two (2) windows along with electronics.

3.3.3 Relays

The relays shall be electromagnetic type suitable for specified control supply. Its contact configuration and rating shall be suitable for the specified control function. However minimum contact rating shall be 5 Amp AC & 2 Amp DC as applicable. There shall be ten (10) percent spare contacts.

3.3.4 Timers

The timers shall be electronic type suitable for specified control supply. Its contact configuration and rating shall be suitable for the specified control function. However, minimum contact rating shall be 5 Amp AC & 2 Amp DC as applicable.

3.3.5 Control / Selector Switches

Switches shall be Rotary Cam type with minimum of 5 Amps AC & 2 Amp DC continuous current rating. Selector switches shall be stay put type while control switches shall be spring-return-to-neutral type. Contact configuration and rating shall be as per the control function requirement. The switches shall be lockable type wherever specified. Each switch shall be provided with engraved plates indicating the switch position / functions.

3.3.6 Push Buttons / Indicating Lights

The push buttons shall be momentary action self-resetting type, however stop P.B. for unidirectional drives shall be provided with manual reset facility. Its contact configuration & rating shall be as required for the control function but minimum 2 NO + 2 NC of 5 Amp. AC rating. It shall have round coloured projecting tab and engraved escutcheon plate / inscription plate. Colour coding of push buttons shall be as under:

RED	Motor OFF / Valve CLOSE	YELLOW	Alarm acknowledge	Left Hand Side
GREEN	Motor ON / Valve OPEN	BLACK	Lamp test	Right Hand Side

Indicating lights shall be suitable for direct connections across specified power supplies. It shall be fitted with built in resistance to prevent circuit tripping on shorting of lamp filament. It shall be fitted with LED cluster type lamp replaceable from front.

GREEN	Motor OFF / Valve CLOSED condition	AMBER	Motor tripped	Left Hand Side
RED	Motor ON / Valve OPEN condition	WHITE	Normal / healthy	Right Hand Side

3.3.7 Ammeters

Ammeter shall be 96 x 96 mm size, 90 deg. deflection, 1.5% accuracy, 1 Amp. CT operated or with 4-20mA input and Flush mounting type as called for in the data sheet-A (No. PES-145-54A-DS1-0). Ammeters for motors shall have six (6) times folded scale at upper end to enable motor starting current indication

3.3.8 Miniature Circuit Breaker (MCB)

These shall be instantaneous magnetic trip type for short circuit in addition to current time inverse delayed thermal trip feature for over current protection. The housing of MCB shall be made of non-ignitable, high impact material. It shall have minimum short circuit rating of 9 KA for AC Voltages and 4 KA for DC Voltages.

3.3.9 Makes of various instruments / devices shall be as given below

1.	Alarm Annunciators	:	Procon / IIC
2.	Ammeters	:	AEP / IMP
3.	Control / Selector Switches	:	Alsthom / Kaycee / Siemens / L&T
4.	Push Buttons / Indicating Lamps	:	Siemens / L&T / Teknic / Alsthom
5.	Auxiliary Relays	:	Jyoti / Siemens / L&T / OEN
6.	Timers	:	L&T / Alsthom / Bhartiya Cutler Hammer
7.	MCBs	:	S&S Power Engg. / Indo Asian / MDS
8.	Terminal Blocks	:	Jyoti / Elmex

4.0 TESTING AND INSPECTION

4.1 The bidder shall adopt suitable quality assurance program to ensure that the equipments offered will meet the specification requirements in full.

4.2 BHEL's standard Quality Plan for LCP is enclosed with the specification. The bidder shall furnish his acceptance to BHEL's QP and submit the signed and stamped copy of QP along with the offer.

4.3 The vendor shall conduct the following tests as a minimum requirement:

4.3.1 Routine Tests

1. High Voltage (H.V.)
2. Insulation Resistance (I.R.)
3. Functional

4.3.2 Type Tests

1. Enclosure Class Test

5.0 SPARES AND CONSUMABLES

5.1 Commissioning Spares and consumables

The bidder shall supply all commissioning spares and consumables 'as required' during Start-up, as part of the main equipment supply.

5.2. Mandatory Spares

The bidder shall offer alongwith main offer, the Mandatory Spares as specified elsewhere in the specification. The Mandatory Spares offered shall be of the same make and type as the main equipment.

5.3. Recommended Spares

The bidder shall furnish a list of Recommended Spares indicating the normal service expectancy period and frequency of replacement; quantities recommended for 3 years operation alongwith unit rate against each item to enable BHEL/BHEL's Customer to place a separate order later, if required.

6.0 DRAWINGS AND DOCUMENTS

6.1 The bidder shall furnish the following documents in required number of copies along with the bid :

1. Data Sheet no. PES-145A-DS1-0
2. General Arrangement Drawing.
3. Catalogue and technical information for instruments and devices.
4. Quality Plan.

6.2 The vendor shall furnish the following documents in required number as agreed after the award of contract:

1. Data Shee No. PES-145A-DS2-0
2. GA Drawing indicating layout of instruments, construction details, foundation details, cable gland plate alongwith cable glands and all details mentioned in this specification.
3. Control Schematic Diagram along with grouping of different terminals for various functions.
4. Catalogue and technical information for instruments and devices with selected options clearly marked.
5. O&M Manuals.
6. "As Built" Drawing.
7. CDs.

7.0 MARKING AND PACKING

7.1 Panel with all instruments / devices mounted on it shall be suitably packed & protected for the entire period of despatch, storage and erection against impact, abrasion, corrossion, incidental damage due to vermin, sunlight, high temperature, rain moisture, humidity, dust, sea-water spray (where applicable) as well as rough handling and delays in Transit and storage in open.

8.0 APPLICABLE DATA SHEET FORMS

This document shall be read with one or more of the following data sheet forms :

- Data sheet A&B for Local Panels : Data sheet no. PES-145A-DS1-0
- Data sheet C for Local Panels : Data sheet no. PES-145A-DS2-0

UNPRICED SCHEDULE

	TITLE:	SPECIFICATION NO.	PE-TS-226-174-A001
BHEL	SCHEDULE OF PRICES	VOLUME	III
		SECTION	DATE
		REV. NO.	00 SHEET OF

SL. No.	DESCRIPTIONS OF WORKS OR EQUIPMENT	PRICE (In Lacs of Rs.)
1.0	**GUJARAT STATE ELECTRICITY CORPORATION LTD.** **2X250 MW, GHTP STAGE-II,LEHERA MOHABAT UNIT 3 & 4**	
	Total lump sum firm price on FOR site basis for design, engineering, manufacturing, painting, inspection & testing at manufacturer's works, complete with all accessories including start up and commissioning spares, packing, shipment and delivery to Power Station Site for missing items and replacement of defective item in the existing partially supplied/ partially erected chlorination plant. In addition, the bidder's scope shall include erection (except already erected) and commissioning, unloading, storage and handling at site, site testing, trial run, obtaining clearance from Explosive department demonstration tests and handing over to customer complete with all accessories as required for the total scope defined as per BHEL specification no. PE-TS-226-174-A001 CHLORINATION PLANT for 2X250 MW, GHTP STAGE-II, LEHERA MOHABAT UNIT 3 & 4.	**Total Rs.**
	NOTE	
A	Bidder to note that total price indicated above at 1.0 shall be considered for evaluation and hence, should be complete in all respect for the full scope defined and considering all terms and conditions agreed.	
B	In case, price indicated above does not match with item wise break-up given at 2.0, the highest price so calculated shall be considered for evaluation but in case of order, the same shall be placed at the lowest price.	
2.0	**BREAK-UP OF PRICES GIVEN IN 1.0 ABOVE**	
2.1	Total lump sum firm price on FOR site basis for design, engineering, manufacturing, painting, inspection & testing at manufacturer's works, complete with all accessories including start up and commissioning spares, packing, shipment and delivery to Power Station Site for missing items and replacement of defective item in the existing partially supplied/ partially erected chlorination plant for the complete scope of supply of Gas chlorination plant defined in the BHEL tender specification PE-TS-226-174-A001 for delivery up to site basis (freight included).	
2.2	Total lump sum firm price for all services including erection (except already erected) and commissioning, unloading, storage and handling at site, site testing, trial run, obtaining clearance from Explosive department, demonstration tests, handover etc required for completion of Chlorination Plant as per tender specification .	
2.3	Taxes & duties etc.	
2.4	Erection & Commissioning	
2.5	Demonstration test and handing over the plant to customer.	

Bidder shall furnish this price Schedule in his price offer only

PARTICULARS OF BIDDER/ AUTHORISED REPRESENTATIVE

NAME	DESIGNATION	SIGNATURE	DATE	COMPANY SEAL

SCHEDULE OF DECLARATIONS

I ……..……certify that all the technical data and information pertaining to this specification are correct and are true representation of the equipment/system covered by our format proposal number Dated …….. and there is no deviation to the specification.

I hereby certify that I am duly authorized representative of the Bidder's company whose name appears above my signature.

Bidders Company Name
……

Authorized representative's
Signature ……..

Name …….

Bidder's Name The bidder hereby agrees to fully comply with

the requirements and intent of this specification for the price indicated

COMPLIANCE CERTIFICATE

The bidder shall confirm compliance with following by signing/ stamping this compliance certificate and furnishing same with the offer:

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions/ deviations with regard to same.
2. QP will be subject to BHEL/Customer approval in the event of order & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc.
   The charges for 3rd party inspection (Lloyds, TUV or equivalent) for imported components shall be included in the base price of the equipment by the bidder.
3. All drawings/data – sheets etc. to be submitted during contract shall be subject to BHEL/Customer review/ approval. GA drawings, as submitted with offer at tender stage are for reference purpose only and shall be subject to approval during contract stage.
4. There are no other deviations with respect to specification other than those furnished in the 'Schedule of Deviations'.
5. The offered materials shall be either equivalent or superior to those specified. Also for components where material is not specified it shall be suitable for intended duty, materials shall be subject to approval in the event of order.
6. The commissioning spares (if any) are supplied on 'As Required Basis' & prices for same included in the base price (If bidders reply to this is "No commissioning spares are required" and if some spares are actually required during commissioning same shall be supplied by bidder without any cost to BHEL).
7. All sub vendors shall be subject to BHEL/CUSTOMER approval.
8. Any special tools & tackles, if required, shall be in bidder's scope.
9. The Performance of the system shall stand valid till the satisfactory completion of performance testing and its acceptance by purchaser/customer.
10. Prices for recommended spares (if any) for three year operation shall be furnished separately and not to be included in the base price.