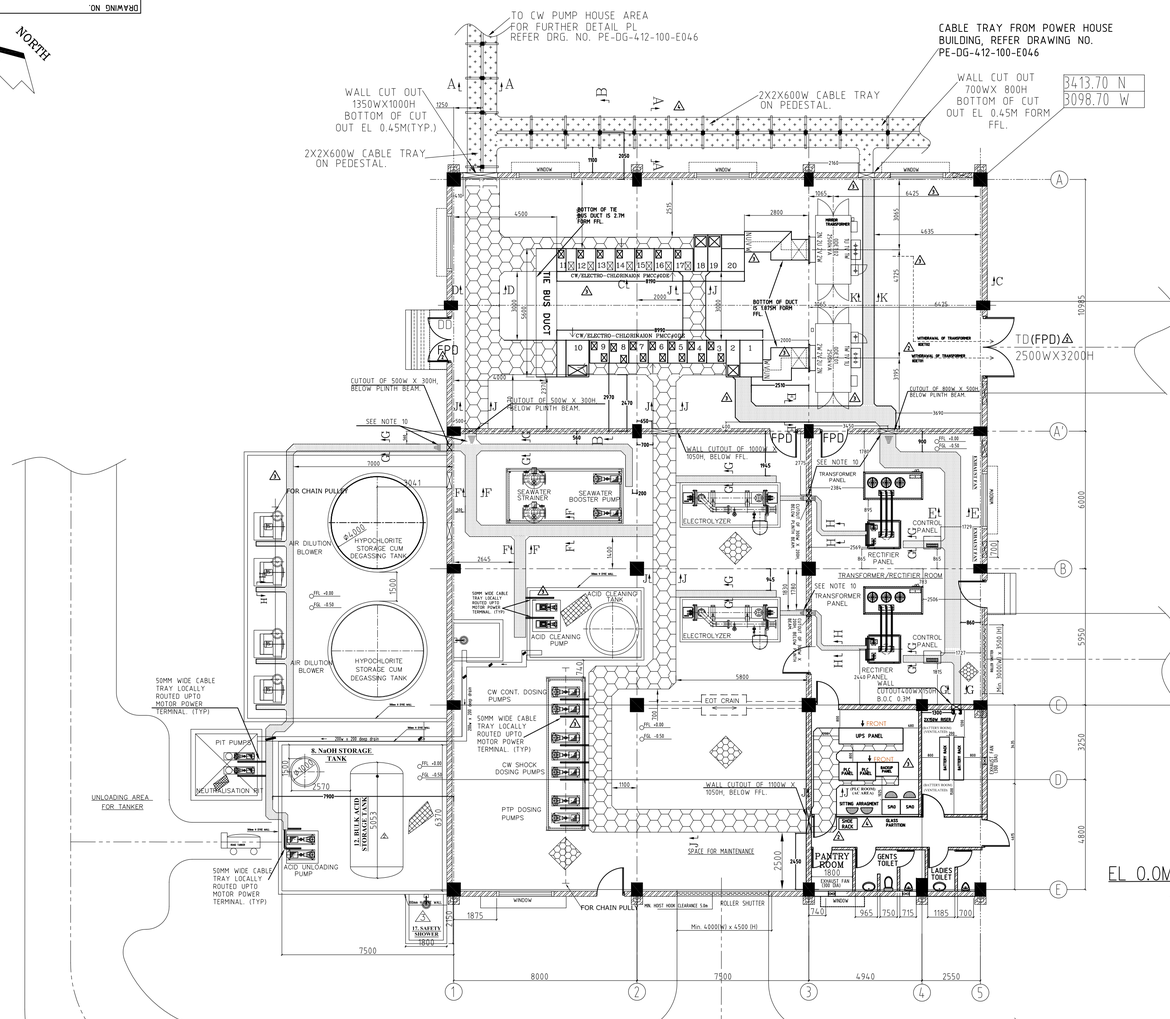
S.No.	Desein/ TANGEDCO'S Comments	BHEL Reply dated 27.09.2018 along with R2	Desein/ TANGEDCO'S Comments	BHEL Reply dated 20.11.2018 along with R3	Desein/ TANGEDCO'S Comments	BHEL Reply dated 13.01.2023 along with R4
2	UPS as per approved UPS scheme for off-site package (Document No. PE-DG-412-145-I004) shall be provided by BHEL as per approved DM. UPS Room with battery room shall also be provided for accommodating the UPS and batteries accordingly.	UPS Panel and batteries Indicated in the updated control room layout.	Noted. Locations of UPS panels and OWS shall be interchanged. UPS panels shall be shifted "C" row.	Noted and incorporated in the revised layout.	Noted UPS panel is repeated twice. Correct the same	Checked, and found that only single UPS panel is shown without any repetition, in previous R-3 also.
3	Minimum one number Gent's toilet with adequate facilities including drinking water space and Janitor's space shall be provided at each level/elevation of building. In addition one no. ladies toilet shall be provided at ground floor, and operating floor level.	Please refer the updated control room layout.	Noted. Common access for control room with pantry and toilets are not acceptable, as the control room is the air conditioned area. Please provide the Glass partition between common lobby for toilets, pantry and control room.	Glass partition indicated in the revised layout.	Please indicated the same	Noted; incorporated in plan & legend also
4			ATLEAST THIS PORTION SHOULD BE OVERHEAD.	Cable tray pedestal arrangement has been relocated close to the wall along A row to ensure space utilization. After the relocation overhead clearance is not required.	Refer response at S.No. 1 above	Refer response/reply at S.No. 1 above.
5			WHY IS IT BEING BLOCKED.	Refer reply at sl. no. 23 above.	Refer response at S.No. 1 above	Refer response/reply at S.No. 1 above



LEGEND:–

- CABLE TRENCH
- CABLE SLIT
- DD — DOUBLE DOOR (DD)
- TD — TRANSOM DOOR (TD)
- SINGLE LEAF DOOR
- FRONT OF THE PANEL
- WALL
- CABLE TRAY
- 2 FPD — FIRE PROOF DOOR
- 4 — GLASS PARTITION

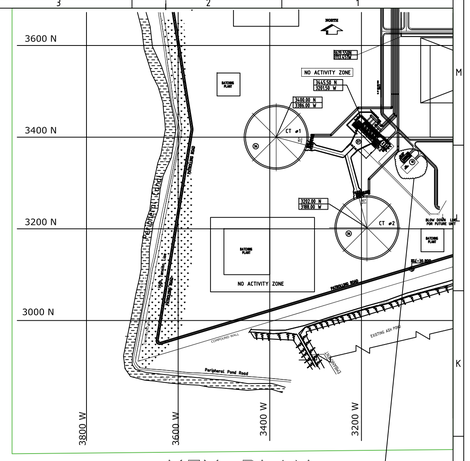
TABLE FOR CABLE TRAYS & CANTELEVER ARMS

TRAY WIDTH IN MM	CANTILEVER ARM LENGTH (L) IN MM
150	200
300	350
450	500
600	650

3 BILL OF QUANTITY

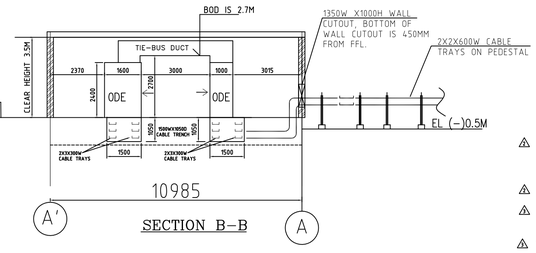
S.NO.	MATERIAL DESCRIPTION	UNIT	QUANTITY
01	CABLE TRAY 300MM WIDE (LADDER TYPE)	METRES	220
02	CABLE TRAY 300MM WIDE (PERFORATED TYPE)	METRES	110
03	CABLE TRAY 50MM WIDE (LADDER TYPE)	METRES	100
04	CANTILEVER ARM(350MM LEGTH)	NOS	220
05	SINGLE CHANNEL CI	METRES	430
06	BASE PLATE BP1 FOR SINGLE CHANNEL	NOS.	146
07	CHANNEL CLAMP CC1 FOR SINGLE CHANNEL	NOS	146
08	TRAY FIXING CLAMP, TC1	NOS	50
09	90° HORIZONTAL BEND 300MM WIDE (LADDER)	NOS.	10
10	90° HORIZONTAL BEND 300MM WIDE (PERFORATED)	NOS.	5
11	TEE 300MM WIDE (LADDER)	NOS.	14
12	TEE 300MM WIDE (PERFORATED)	NOS.	7

※ FOR DETAILS, PLEASE REFER SR NO.-10 OF REFERENCE DRAWING.

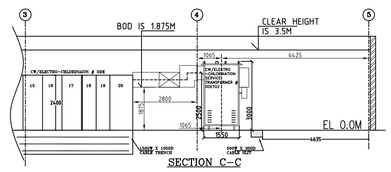


NOTES:–

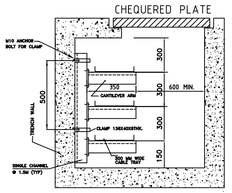
1. ALL DIMENSIONS ARE IN MM AND ELEVATIONS IN METRES.
2. ALL ELEVATIONS MARKED ARE W.R.T. TG HALL FINISHED FLOOR LEVEL AS 0.0M WHICH CORRESPONDS TO EL 10.0M.
3. FOR LT PANELS FIXING TYPICAL INSERT DETAILS ARE INDICATED FOR INCLUSION IN CIVIL DRAWINGS FOR SWITCHGEAR.
4. LT PANEL & LDB DIMENSIONS SHALL BE UPDATED AS PER FINAL OGAs OF EQUIPMENT MANUFACTURER.
5. ALL PANELS ARE SUITABLE FOR BOTTOM ENTRY OF CABLES, FOR WHICH CUTOUTS SHALL BE SHOWN IN CIVIL DRAWINGS FOR SWITCHGEAR ROOM FLOOR GA AS PER THIS DRAWING.
6. BLOCKING OF THE CABLLE ENTRY TO PANEL BY FLOOR BEAM WILL BE TAKEN CARE WHILE PLACEMENT OF THE PANEL, IF ANY PANEL HAS TO BE PLACED ON FLOOR BEAM DUMMY PANEL/ VACCANT MODULE SHALL BE PROVIDED.
7. RESPECTIVE MANUFACTURER DRAWING SHALL BE REFERRED FOR FOLLOWING DETAILS:–
   A) SWGR. / MCCs : DETAILED OGA/ FLOOR PLAN/ LOADING.
   B) SERVICE TRANSFORMERS. : DETAILED OGA/ FLOOR PLAN/ BUSDUCT MOUNTING FLANGE/ LOADING.
   C) LV BUSDUCTS : DETAILED OGA.
8. THIS DRAWING SHALL BE REFERRED ONLY FOR SWITCHGEAR. FOR ALL OTHER MECHANICAL/ CIVIL DETAILS APPLICABLE DRAWINGS SHALL BE REFERRED.
9. ALL CABLE OPENINGS IN WALLS FLOORS SHALL BE SEALED WITH CABLE FIRE SEALING SYSTEM MATERIAL AFTER COMPLETION OF CABLE LAYING.
10. CABLE SLITS SHALL BE LOCALLY DEEPENED FOR A LENGTH OF APPROX 1M.
11. ⚠ LOAD OF CABLE TRAY ALONG WITH CABLE WITH SUPPORT HAS BEEN CONSIDERED AS MINIMUM 100KG, 75KG, 50KG, 25KG FOR 600 WIDE, 450 WIDE, 300 WIDE & 150 WIDE CABLE TRAYS RESPECTIVELY.
12. ⚠ ACID PROOF FLOORING SHALL BE PROVIDED IN BATTERY ROOM.
13. ⚠ PANEL SUPPORTING STRUCTURE TO BE PROVIDED BY PEM-CIVIL & ERECTION AT SITE SHALL BE DONE IN LINE WITH DETAILS INDICATED IN PANEL SHIPPING SECTION DETAILS.
14. ⚠ AIR CURTAINS SHALL BE PROVIDED AT ENTRANCE OF CONTROL ROOM.



SECTION B–B

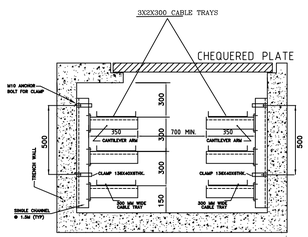


SECTION C–C



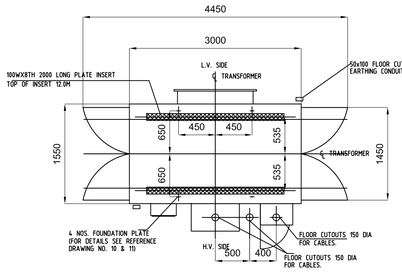
SECTION J–J

1000WX 1050D CABLE TRENCH (NTS)

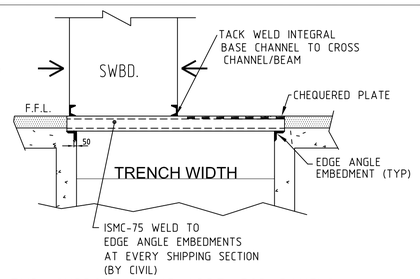


SECTION D–D

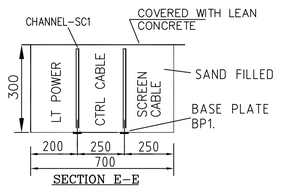
1500WX 1050D CABLE TRENCH (NTS)



TYPICAL FOUNDATION PLAN FOR 2500 kVA DRY TYPE TRANSFORMER (TYP.)

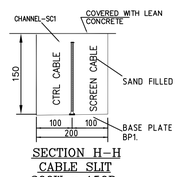


TYP. SUPPORT/FIXING ARRT. FOR PANELS OVER CABLE TRENCH



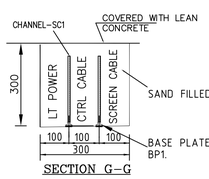
SECTION E–E

CABLE SLIT 700W x 300D



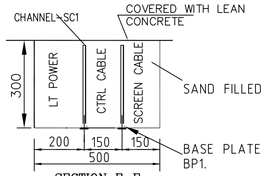
SECTION H–H

CABLE SLIT 200W x 150D



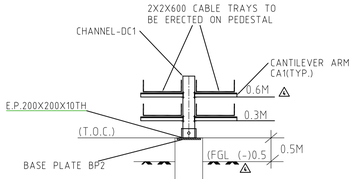
SECTION G–G

CABLE SLIT 300W x 300D

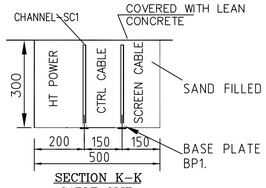


SECTION F–F

CABLE SLIT 500W x 300D



SECTION A–A



SECTION K–K

CABLE SLIT 500W x 300D

REF DRG.

SL.NO.	DRAWING NAME	DRAWING NO.	SOURCE
1.	PLOT PLAN	PE-DG-412-100-M001	PEM/ MPL
2.	CROSS SECTION OF MAIN PLANT	PE-DG-412-100-M007	PEM/ MPL
3.	ELECTRICAL SINGLE LINE DIAGRAM	PE-DG-412-565-E001	PEM/ ELECT
4.	INTERPLANT CABLING ZONE-D	PE-DG-412-100-E046	PEM/ ELECT
⚠ 5.	OGA FOR 2500 KVA TRF.	34730051892	BHEL-JHANSI
⚠ 6.	OGA FOR 2500 KVA TRF(MIRROR TYPE).	34730052291	BHEL-JHANSI
7.	GA & FOUND. PLAN FOR ODE	EP-3-GA-063-015	BHEL-EPD
8.	DESIGN PHILOSOPHY OF ELECT EQUP LAYOUT	PE-DC-412-100-E101	PEM/ELECT
9.	CABLE ERECTION PHILOSOPHY	PE-DG-412-565-E004	PEM/ ELECT
10.	INSTALLATION DETAILS FOR CABLE TRAY SUPPORT SYSTEM	PE-DG-412-565-E006	PEM/ ELECT
⚠ 11.	EQUIPMENT LAYOUT FOR ELECTRO CHLORINATION PLANT FOR CW SYSTEM	PE-V11-412-174-A103	PEM/ MAUX
⚠ 11.	CHLORINATION BUILDING - ARCHITECTURAL ELEVATION AND SECTION	PE-DG-412-637-C002	PEM/ CIVIL

REV.	DATE	ALTD	CHD	APPD	SL
4	15.01.23	REO/VKS	AS	SL	
1	DRAWING HAS BEEN REVISED IN LINE WITH TANGEDCO LETTER REF: Lr.No.DE/E/TNSTC/SE-4/ASE/D/F/ENNORE SEZ DRG APP'd/5.202/21 DT 30.04.2021				

REV.	DATE	ALTD	CHD	APPD	SL
3	04.12.18	RK/VKS	VY	SL	
1	DRAWING HAS BEEN REVISED IN LINE WITH DESEIN LETTER REF: D-4027/TANGEDCO/4425 DATED 20.10.18.				
2	DRAWING HAS BEEN REVISED IN LINE WITH TANGEDCO LETTER REF: Lr.No.DE/E/TNSTC/SE-4/ASE/D/F/ENNORE SEZ DRG APP'd/5.804/18 DT 28.11.2018.				

REV.	DATE	ALTD	CHD	APPD	SL
2	27.09.18	REO/VKS	VY	SL	
1	DRAWING HAS BEEN REVISED IN LINE WITH DESEIN LETTER REF: 5744 DATED 10.08.18 & TANGEDCO LEETTER REF: D.433/18 DATED 17.08.18.				

REV.	DATE	ALTD	CHD	APPD	SL
1	20.07.18	VKS	VY	SL	
	DRAWING HAS BEEN REVISED IN LINE WITH LATEST MECHANICAL & CIVIL DRAWING.				

PROJECT: 2x660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI

CUSTOMER: TAMILNADU GENERATION AND DISTRIBUTION CORPORATION LIMITED (TANGEDCO)

CONSULTANT: DESEIN PRIVATE LIMITED, DESEIN HOUSE, GREATER KAILASH–II, NEW DELHI

JOB NO. 412
STATUS CONTRACT
DISTRIBUTION
TO

BHARAT HEAVY ELECTRICALS LTD, POWER SECTOR, PROJECT ENGINEERING MANAGEMENT, NEW DELHI

DEPT CODE		NAME	SIGN	DATE
No. OF DRN	SM/RKG		–SD–	27.03.18
E	DESN	VKS	–SD–	27.03.18
	CHD	VY	–SD–	27.03.18
	APPD	SL	–SD–	27.03.18

TITLE: ELECTRICAL EQUIPMENT & CABLE TRAY LAYOUT IN ELECTRO–CHLORINATION PLANT

DEPT. | SCALE: | DRAWING NO. PE-DG-412-100-E049
SIGN
DATE
SHEET 1 OF 1 | REV. 4

FORMAT SIZE A0

ELECTRONIC FILE NAME: FILEPATH

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

REV	DATE	ALTERED: / CHECKED:	REV	DATE	ALTERED / CHECKED

APPROVED

STATUS : CONTRACT

JOB NO.: 412

2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

BHARAT HEAVY ELECTRICALS LIMITED
PROJECTS ENGINEERING MANAGEMENT, NOIDA.

BHEL DOC NO.: PE-V11-412-174-A128 A

DE NORA

SUB CONTRACTOR : DE NORA INDIA LIMITED
KUNDAIM - GOA

ASSOCIATE PARTNER : DE NORA WATER TECHNOLOGIES
SINGAPORE BRANCH

LOA NO: PW/PE/PG/EN1/P-24/17 DATED: 22 APR 2017

DEPT.	CODE		SCALE	WEIGHT(KG)	REF DRG.	ITEM
--	A		-	-	-	-

QAP - ICL FOR ELECTRO CHLORINATION PLANT (BALANCE OF ITEMS)

	NAME	SIGN	DATE
PREP	SN		
CHKD	PG		
APPD	RF		

DEPT.					CARD CODE	BHEL DOC NO.:	REV
SIGN					-	PE-V11-412-174-A128 A	0
DATE						NO. OF SHEETS 11 EXCLUDING COVER PAGE	

BHARAT HEAVY ELECTRICALS LTD
PROJECT ENGINEERING MANAGEMENT.
This approval status shall be interpreted as laid down in the contract and it shall not relieve the contractor from the contractual obligation.
APPROVAL CATEGORY AWARDED = I
CAT I - Approved
CAT II - Approved With Comments as Noted
CAT III - Not Approved
CAT IV - Reference Drawing
DEPARTMENT: MECHANICAL AUXILIARY
NAME: FALGUNI SAHA
DATE: 2018.12.20 12:58:47 +05'30'

QUALITY PLAN	CLIENT: BHEL, NEW DELHI	PROJECT TITLE:	2 X 660MW ENNORE SEZ COAL BASED SUPERCRITICAL THERMAL POWER	END USER: TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)
	VENDOR: DE NORA INDIA LIMITED	QUALITY PLAN NO:	PE-V11-412-174-A128A	
Sheet 1 of 3	SYSTEM: ELECTRO CHORINATION PACKAGE	ITEM:	FRP BULK STORAGE TANK	

LEGEND DETAILS: P – Perform, W – Witness, V – Verify, 1 – BHEL/ TANGEDCO, 2 – De Nora India Ltd., 3 – Sub Vendor, IR – Inspection Report, TC – Test Certificate.

SR. NO.	COMPONENT & OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTEND OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORM	FORMAT OF RECORD	INSPECTION AGENCY			REMARKS
									P	W	R	
1	2	3	4	5	6	7	8	9	10			11
1.	RAW MATERIAL											
1.1.	RESIN (NORMAL VINYLESTER)	CHEMICAL & PHYSICAL PROPERTIES	MAJOR	DOCUMENT REVIEW	100%	DATASHEET	M.T.C	M.T.C	3		1, 2	
1.2.	CHOPPED STRAND MAT 450	CHEMICAL & PHYSICAL PROPERTIES	MAJOR	DOCUMENT REVIEW	100%	DATASHEET	M.T.C	M.T.C	3		1, 2	
1.3.	WOVEN ROVING MAT 600 GMS/M2	CHEMICAL & PHYSICAL PROPERTIES	MAJOR	DOCUMENT REVIEW	100%	DATASHEET	M.T.C	M.T.C	3		1, 2	
1.4.	SURFACE MAT 30GM/M2	CHEMICAL & PHYSICAL PROPERTIES	MAJOR	DOCUMENT REVIEW	100%	DATASHEET	M.T.C	M.T.C	3		1, 2	
2.	IN PROCESS											
2.1.	EXAMINATION OF HAND LAY-UP	LAMINATION	MAJOR	VISUAL INSPECTION	100%	APPROVED DRAWING FOR LAYING SEQUENCE	APPROVED DRAWING FOR LAYING SEQUENCE	IR	3		1, 2	
2.2.	VERIFICATION OF CURING	HARDNESS	MAJOR	HARDNESS INSPECTION	100%	APPROVED DRAWING FOR LAYING SEQUENCE	APPROVED DRAWING FOR LAYING SEQUENCE	IR	3		1, 2	

BHARAT HEAVY ELECTRICALS LTD
PROJECT ENGINEERING MANAGEMENT.

This approval status shall be interpreted as laid down in the contract and it shall not relieve the contractor from the contractual obligation.

APPROVAL CATEGORY AWARDED = I

CAT I - Approved
CAT II - Approved With Comments as Noted
CAT III - Not Approved
CAT IV - Reference Drawing

DEPARTMENT	MECHANICAL AUXILIARY
NAME: FALGUNI SAHA	20/12/2018

PARTICULARS	
NAME	
SIGNATURE	
DATE	

DE NORA INDIA LIMITED
Plot Nos: 184, 185 & 189, Kundaim Industrial Estate, Kundaim - 403115, Goa, India.

बी एच ई एल BHEL	QUALITY PLAN	CLIENT: BHEL, NEW DELHI	PROJECT TITLE:	2 X 660MW ENNORE SEZ COAL BASED SUPERCRITICAL THERMAL POWER	END USER: TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)
		VENDOR: DE NORA INDIA LIMITED	QUALITY PLAN NO:	PE-V11-412-174-A128A	
	Sheet 2 of 3	SYSTEM: ELECTRO CHORINATION PACKAGE	ITEM:	FRP BULK STORAGE TANK	

LEGEND DETAILS: P – Perform, W – Witness, V – Verify, 1 – BHEL/ TANGEDCO, 2 – De Nora India Ltd., 3 – Sub Vendor, IR – Inspection Report, TC – Test Certificate.

SR. NO.	COMPONENT & OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTEND OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORM	FORMAT OF RECORD	INSPECTION AGENCY			REMARKS
									P	W	R	
1	2	3	4	5	6	7	8	9	10			11
3.	FINAL INSPECTION											
3.1.	TANKS - SHELL, DISH, NOZZLES, FLANGES, SUPPORTS, LADDER, HAND RAILING, PLATFORM, ETC.	VISUAL INSPECTION	MAJOR	VISUAL	100%	APPROVED DRAWING FOR LAYING SEQUENCE	APPROVED DRAWING FOR LAYING SEQUENCE	IR	3	2	1	
3.2.	TANKS - SHELL, DISH, NOZZLES, FLANGES, SUPPORTS, LADDER, HAND RAILING, PLATFORM, ETC.	FINAL DIMENSION & THICKNESS TEST	MAJOR	MEASURE	100%	APPROVED GA DRAWING	APPROVED GA DRAWING	IR	3	2	1	
3.3.	LOCATION OF ACCESSORIES AND NOZZLE ORIENTATION	VISUAL INSPECTION	MAJOR	VISUAL	100%	APPROVED GA DRAWING	APPROVED GA DRAWING	IR	3	2		
3.4.	COMPLETE TANK	HYDRO TEST	CRITICAL	WATER FILL UP TEST	100%	APPROVED DRAWING	NO LEAKAGE	TEST REPORT	3	2		
3.5.	COMPLETE TANK	BARCOL TEST	MAJOR	VISUAL & MEASURE	1 TEST COUPAN	ASTM D-2583 (BS 4994)	ASTM D-2583 (BS 4994)	M.T.C.	3		1	32 MINS

BHARAT HEAVY ELECTRICALS LTD
PROJECT ENGINEERING MANAGEMENT.

This approval status shall be interpreted as laid down in the contract and it shall not relieve the contractor from the contractual obligation.

APPROVAL CATEGORY AWARDED = I

CAT I - Approved
CAT II - Approved With Comments as Noted
CAT III - Not Approved
CAT IV - Reference Drawing

DEPARTMENT	MECHANICAL AUXILIARY
NAME: FALGUNI SAHA	20/12/2018

PARTICULARS
NAME
SIGNATURE
DATE

DE NORA INDIA LIMITED
Plot Nos: 184, 185 & 189, Kundaim Industrial Estate, Kundaim - 403115, Goa, India.

बी एच ई एल BHEL	QUALITY PLAN	**CLIENT:** BHEL, NEW DELHI	**PROJECT TITLE:**	2 X 660MW ENNORE SEZ COAL BASED SUPERCRITICAL THERMAL POWER	**END USER:** TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)
		VENDOR: DE NORA INDIA LIMITED	**QUALITY PLAN NO:**	PE-V11-412-174-A128A	
	Sheet **3** of **3**	**SYSTEM:** ELECTRO CHORINATION PACKAGE	**ITEM:**	FRP BULK STORAGE TANK	

LEGEND DETAILS: P – Perform, W – Witness, V – Verify, 1 – BHEL/ TANGEDCO, 2 – De Nora India Ltd., 3 – Sub Vendor, IR – Inspection Report, TC – Test Certificate.

SR. NO.	COMPONENT & OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTEND OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORM	FORMAT OF RECORD	INSPECTION AGENCY			REMARKS
									P	W	R	
1	2	3	4	5	6	7	8	9	10			11
3.6.		FLEXURAL TEST/ TENSILE STRENGTH TEST	MAJOR	VISUAL & MEASURE	PER TANK	ASTM D-790 / ASTM D-638 (BS 4994)	ASTM D-790 / ASTM D-638 (BS 4994)	M.T.C.	3		1	85 N MM2
3.7.		GLASS CONTENT TEST	MAJOR	VISUAL & MEASURE		ASTM-2584 (BS 4994)	ASTM-2584 (BS 4994)	M.T.C.	3		1	35 +/- 5%
3.8.	NAMEPLATE & TAGGING	VISUAL INSPECTION	MAJOR	VISUAL	100%	APPROVED GA DRAWING	APPROVED GA DRAWING		3	2		
3.9.	ACETONE WIPE TEST	VISUAL INSPECTION	MAJOR	VISUAL	10%			TEST REPORT	3		1	TO CHECK SURFACE CURE
4.	**PACKING**											
4.1.	COMPLETE TANK & ITS ACCESSORIES	VISUAL INSPECTION	MAJOR	VISUAL	100%				3		1	AS ALL EQUIPMENTS ARE FULL LOAD CONSIGNMENT NO NEED FOR PACKING

BHARAT HEAVY ELECTRICALS LTD
PROJECT ENGINEERING MANAGEMENT.

This approval status shall be interpreted as laid down in the contract and it shall not relieve the contractor from the contractual obligation.

~~APPROVAL CATEGORY AWARDED = I~~
CAT I - Approved
CAT II - Approved With Comments as Noted
CAT III - Not Approved
CAT IV - Reference Drawing

DEPARTMENT	MECHANICAL AUXILIARY
NAME: FALGUNI SAHA	20/12/2018

PARTICULARS
NAME
SIGNATURE
DATE

THANE PLAST PVT. LTD.

DE NORA INDIA LIMITED
Plot Nos: 184, 185 & 189, Kundaim Industrial Estate, Kundaim - 403115, Goa, India.

BHEL	QUALITY PLAN	**CLIENT:** BHEL, NEW DELHI	**PROJECT TITLE:**	2 X 660MW ENNORE SEZ COAL BASED SUPERCRITICAL THERMAL POWER
		VENDOR: DE NORA INDIA LIMITED	**QUALITY PLAN NO:**	PE-V11-412-174-A128A
	Sheet 1 of 3	**SYSTEM:** ELECTRO CHORINATION PACKAGE	**ITEM:**	VERTICAL FRP TANK WITH TOP DISH & FLAT BOTTOM
			END USER:	TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)

LEGEND DETAILS: P – Perform, W – Witness, V – Verify, 1 – BHEL/ TANGEDCO, 2 – De Nora India Ltd., 3 – Sub Vendor, IR – Inspection Report, TC – Test Certificate.

SR. NO.	COMPONENT & OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTEND OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORM	FORMAT OF RECORD	INSPECTION AGENCY			REMARKS
									P	W	R	
1	2	3	4	5	6	7	8	9	10			11
1.	**RAW MATERIAL**											
1.1.	RESIN (NORMAL VINYLESTER)	CHEMICAL & PHYSICAL PROPERTIES	MAJOR	DOCUMENT REVIEW	100%	DATASHEET	M.T.C	M.T.C	3		1, 2	
1.2.	CHOPPED STRAND MAT 450	CHEMICAL & PHYSICAL PROPERTIES	MAJOR	DOCUMENT REVIEW	100%	DATASHEET	M.T.C	M.T.C	3		1, 2	
1.3.	WOVEN ROVING MAT 600 GMS/M2	CHEMICAL & PHYSICAL PROPERTIES	MAJOR	DOCUMENT REVIEW	100%	DATASHEET	M.T.C	M.T.C	3		1, 2	
1.4.	SURFACE MAT 30GM/M2	CHEMICAL & PHYSICAL PROPERTIES	MAJOR	DOCUMENT REVIEW	100%	DATASHEET	M.T.C	M.T.C	3		1, 2	
2.	**IN PROCESS**											
2.1.	EXAMINATION OF HAND LAY-UP	LAMINATION	MAJOR	VISUAL INSPECTION	100%	APPROVED DRAWING FOR LAYING SEQUENCE	APPROVED DRAWING FOR LAYING SEQUENCE	IR	3		1, 2	
2.2.	VERIFICATION OF CURING	HARDNESS	MAJOR	HARDNESS INSPECTION	100%	APPROVED DRAWING FOR LAYING SEQUENCE	APPROVED DRAWING FOR LAYING SEQUENCE	IR	3		1, 2	

BHARAT HEAVY ELECTRICALS LTD
PROJECT ENGINEERING MANAGEMENT.

This approval status shall be interpreted as laid down in the contract and it shall not relieve the contractor from the contractual obligation.

APPROVAL CATEGORY AWARDED = I

CAT I - Approved
CAT II - Approved With Comments as Noted
CAT III - Not Approved
CAT IV - Reference Drawing

DEPARTMENT	MECHANICAL AUXILIARY
NAME: FALGUNI SAHA	20/12/2018

PARTICULARS
NAME
SIGNATURE
DATE

DE NORA INDIA LIMITED
Plot Nos: 184, 185 & 189, Kundaim Industrial Estate, Kundaim - 403115, Goa, India.

QUALITY PLAN	**CLIENT:** BHEL, NEW DELHI	**PROJECT TITLE:**	2 X 660MW ENNORE SEZ COAL BASED SUPERCRITICAL THERMAL POWER	**END USER:** TA-MILNADU GENERA-TION AND DISTRIBU-TION CORPORATION (TANGEDCO)
	VENDOR: DE NORA INDIA LIMITED	**QUALITY PLAN NO:**	PE-V11-412-174-A128A	
Sheet 2 of 3	**SYSTEM:** ELECTRO CHORINA-TION PACKAGE	**ITEM:**	VERTICAL FRP TANK WITH TOP DISH & FLAT BOTTOM	

LEGEND DETAILS: P – Perform, W – Witness, V – Verify, 1 – BHEL/ TANGEDCO, 2 – De Nora India Ltd., 3 – Sub Vendor, IR – Inspection Report, TC – Test Certificate.

SR. NO.	COMPONENT & OP-ERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTEND OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORM	FORMAT OF RECORD	INSPECTION AGENCY			REMARKS
									P	W	R	
1	2	3	4	5	6	7	8	9	10			11
3.	**FINAL INSPECTION**											
3.1.	TANKS - SHELL, DISH, NOZZLES, FLANGES, SUPPORTS, LADDER, HAND RAILING, PLATFORM, ETC.	VISUAL INSPECTION	MAJOR	VISUAL	100%	APPROVED DRAWING FOR LAYING SEQUENCE	APPROVED DRAWING FOR LAYING SEQUENCE	IR	3	2	1	
3.2.	TANKS - SHELL, DISH, NOZZLES, FLANGES, SUPPORTS, LADDER, HAND RAILING, PLATFORM, ETC.	FINAL DIMENSION & THICKNESS TEST	MAJOR	MEASURE	100%	APPROVED GA DRAWING	APPROVED GA DRAWING	IR	3	2	1	
3.3.	LOCATION OF ACCESSORIES AND NOZZLE ORIENTA-TION	VISUAL INSPECTION	MAJOR	VISUAL	100%	APPROVED GA DRAWING	APPROVED GA DRAWING	IR	3	2		
3.4.	COMPLETE TANK	HYDRO TEST	CRITI-CAL	WATER FILL UP TEST	100%	APPROVED DRAWING	NO LEAKAGE	TEST REPORT	3	2		BEACAUSE OF CAPACITY OF TANKS ARE VERY HIGH WE WILL OFFER SPARK TEST AT 15 KV

BHARAT HEAVY ELECTRICALS LTD
PROJECT ENGINEERING MANAGEMENT.

This approval status shall be interpreted as laid down in the contract and it shall not relieve the contractor from the contractual obligation.

APPROVAL CATEGORY AWARDED = I

CAT I - Approved
CAT II - Approved With Comments as Noted
CAT III - Not Approved
CAT IV - Reference Drawing

DEPARTMENT	MECHANICAL AUXILIARY
NAME: FALGUNI SAHA	20/12/2018

PARTICULARS
NAME
SIGNATURE
DATE

THANE

DE NORA INDIA LIMITED
Plot Nos: 184, 185 & 189, Kundaim Industrial Estate, Kundaim - 403115, Goa, India.

BHEL	QUALITY PLAN	**CLIENT:** BHEL, NEW DELHI	**PROJECT TITLE:**	2 X 660MW ENNORE SEZ COAL BASED SUPERCRITICAL THERMAL POWER	**END USER:** TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)
		VENDOR: DE NORA INDIA LIMITED	**QUALITY PLAN NO:**	PE-V11-412-174-A128A	
	Sheet **3** of **3**	**SYSTEM:** ELECTRO CHORINATION PACKAGE	**ITEM:**	VERTICAL FRP TANK WITH TOP DISH & FLAT BOTTOM	

LEGEND DETAILS: P – Perform, W – Witness, V – Verify, 1 – BHEL/ TANGEDCO, 2 – De Nora India Ltd., 3 – Sub Vendor, IR – Inspection Report, TC – Test Certificate.

SR. NO.	COMPONENT & OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTEND OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORM	FORMAT OF RECORD	INSPECTION AGENCY			REMARKS
									P	W	R	
1	2	3	4	5	6	7	8	9	10			11
3.5.	COMPLETE TANK	BARCOL TEST	MAJOR	VISUAL & MEASURE	1 TEST COUPAN PER TANK	ASTM D-2583 (BS 4994)	ASTM D-2583 (BS 4994)	M.T.C.	3		1	32 MINS
3.6.		FLEXURAL TEST/ TENSILE STRENGTH TEST	MAJOR	VISUAL & MEASURE		ASTM D-790 / ASTM D-638 (BS 4994)	ASTM D-790 / ASTM D-638 (BS 4994)	M.T.C.	3		1	85 N MM2
3.7.		GLASS CONTENT TEST	MAJOR	VISUAL & MEASURE		ASTM-2584 (BS 4994)	ASTM-2584 (BS 4994)	M.T.C.	3		1	35 +/- 5%
3.8.	NAMEPLATE & TAGGING	VISUAL INSPECTION	MAJOR	VISUAL	100%	APPROVED GA DRAWING	APPROVED GA DRAWING		3	2		
3.9.	ACETONE WIPE TEST	VISUAL INSPECTION	MAJOR	VISUAL	10%			TEST REPORT	3		1	TO CHECK SURFACE CURE
4.	**PACKING**											
4.1.	COMPLETE TANK & ITS ACCESSORIES	VISUAL INSPECTION	MAJOR	VISUAL	100%				3		1	AS ALL EQUIPMENTS ARE FULL LOAD CONSIGNMENT NO NEED FOR PACKING

BHARAT HEAVY ELECTRICALS LTD
PROJECT ENGINEERING MANAGEMENT.

This approval status shall be interpreted as laid down in the contract and it shall not relieve the contractor from the contractual obligation.

APPROVAL CATEGORY AWARDED = I

CAT I - Approved
CAT II - Approved With Comments as Noted
CAT III - Not Approved
CAT IV - Reference Drawing

DEPARTMENT	MECHANICAL AUXILIARY
NAME: FALGUNI SAHA	20/12/2018

PARTICULARS
NAME
SIGNATURE
DATE

DE NORA INDIA LIMITED
Plot Nos: 184, 185 & 189, Kundaim Industrial Estate, Kundaim - 403115, Goa, India.

QUALITY PLAN	**CLIENT:** BHEL, NEW DELHI	**PROJECT TITLE:**	2 X 660MW ENNORE SEZ COAL BASED SUPERCRITICAL THERMAL POWER	**END USER:** TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)
	VENDOR: DE NORA INDIA LIMITED	**QUALITY PLAN NO:**	PE-V11-412-174-A128A	
Sheet 1 of 3	**SYSTEM:** ELECTRO CHORINATION PACKAGE	**ITEM:**	VERTICAL MS+FRP TANK WITH TOP DISH & FLAT BOTTOM	

LEGEND DETAILS: P – Perform, W – Witness, V – Verify, 1 – BHEL/ TANGEDCO, 2 – De Nora India Ltd., 3 – Sub Vendor, IR – Inspection Report, TC – Test Certificate.

SR. NO.	COMPONENT & OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTEND OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORM	FORMAT OF RECORD	INSPECTION AGENCY			REMARKS
									P	W	R	
1	2	3	4	5	6	7	8	9	10			11
1.	**RAW MATERIAL**											
1.1.	PLATES FOR SHELL, DISHED END, NOZZLE FLANGES & NOZZLE PIPES.	CHEMICAL & PHYSICAL PROPERTIES	MAJOR	DOCUMENT REVIEW	100%	APPROVED DATASHEET	M.T.C	M.T.C/ LAB T.C.	3		1, 2	
1.2.	PLATES FOR SHELL, DISHED END, NOZZLE FLANGES & NOZZLE PIPES.	DIMENSIONS	MAJOR	MEASUREMENT	AT RANDOM	APPROVED DATASHEET/ DRAWING	APPROVED DATASHEET/ DRAWING	LOG BOOK/ IR	3		1, 2	
1.3.	RESIN (NORMAL VINYLESTER)	CHEMICAL & PHYSICAL PROPERTIES	MAJOR	DOCUMENT REVIEW	100%	DATASHEET	M.T.C	M.T.C	3		1, 2	
1.4.	CHOPPED STRAND MAT 450	CHEMICAL & PHYSICAL PROPERTIES	MAJOR	DOCUMENT REVIEW	100%	DATASHEET	M.T.C	M.T.C	3		1, 2	
1.5.	WOVEN ROVING MAT 600 GMS/M2	CHEMICAL & PHYSICAL PROPERTIES	MAJOR	DOCUMENT REVIEW	100%	DATASHEET	M.T.C	M.T.C	3		1, 2	
1.6.	SURFACE MAT 30GM/M2	CHEMICAL & PHYSICAL PROPERTIES	MAJOR	DOCUMENT REVIEW	100%	DATASHEET	M.T.C	M.T.C	3		1, 2	
2.	**IN PROCESS**											

BHARAT HEAVY ELECTRICALS LTD
PROJECT ENGINEERING MANAGEMENT.

This approval status shall be interpreted as laid down in the contract and it shall not relieve the contractor from the contractual obligation.

APPROVAL CATEGORY AWARDED = I
CAT I - Approved
CAT II - Approved With Comments as Noted
CAT III - Not Approved
CAT IV - Reference Drawing

DEPARTMENT	MECHANICAL AUXILIARY
NAME: FALGUNI SAHA	20/12/2018

PARTICULARS
NAME
SIGNATURE
DATE

THANE

DE NORA INDIA LIMITED
Plot Nos: 184, 185 & 189, Kundaim Industrial Estate, Kundaim - 403115, Goa, India.

QUALITY PLAN	CLIENT: BHEL, NEW DELHI	PROJECT TITLE:	2 X 660MW ENNORE SEZ COAL BASED SUPERCRITICAL THERMAL POWER	END USER: TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)
	VENDOR: DE NORA INDIA LIMITED	QUALITY PLAN NO:	PE-V11-412-174-A128A	
Sheet 2 of 3	SYSTEM: ELECTRO CHORINATION PACKAGE	ITEM:	VERTICAL MS+FRP TANK WITH TOP DISH & FLAT BOTTOM	

LEGEND DETAILS: P – Perform, W – Witness, V – Verify, 1 – BHEL/ TANGEDCO, 2 – De Nora India Ltd., 3 – Sub Vendor, IR – Inspection Report, TC – Test Certificate.

SR. NO.	COMPONENT & OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTEND OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORM	FORMAT OF RECORD	INSPECTION AGENCY			REMARKS
									P	W	R	
1	2	3	4	5	6	7	8	9	10			11
2.1.	WELDING PROCEDURE	WELDER'S ABILITY TO PERFORM	MAJOR	DOCUMENT REVIEW	100%	ASME SECT. IX	ASME SECT. IX	QW 482, 483 &484	3		1, 2	
2.2.	CHECKS ON DISHED END (WHEREVER APPLICABLE)	DIMENSIONS & PROFILE	MAJOR	MEASUREMENT	100%	APPROVED DRAWING	APPROVED DRAWING	IR	3		1, 2	
2.3.	DP TEST ON EDGES, SF & KNUCKLE	SURFACE DEFECTS ON EDGE, SF & KNUCKLE	MAJOR	VISUAL & DP TEST	100%	ASME SEC VIII DIV 1 APPENDIX B	ASME SEC VIII DIV 1 APPENDIX B	IR	3		1, 2	
2.4.	EXAMINATION OF HAND LAY-UP	LAMINATION	MAJOR	VISUAL INSPECTION	100%	APPROVED DRAWING FOR LAYING SEQUENCE	APPROVED DRAWING FOR LAYING SEQUENCE	IR	3		1, 2	
2.5.	VERIFICATION OF CURING	HARDNESS	MAJOR	HARDNESS INSPECTION	100%	APPROVED DRAWING FOR LAYING SEQUENCE	APPROVED DRAWING FOR LAYING SEQUENCE	IR	3		1, 2	
3.	FINAL INSPECTION											
3.1.	TANKS - SHELL, DISH, NOZZLES, FLANGES, SUPPORTS, LADDER, HAND RAILING, PLATFORM, ETC.	VISUAL INSPECTION	MAJOR	VISUAL	100%	APPROVED DRAWING FOR LAYING SEQUENCE	APPROVED DRAWING FOR LAYING SEQUENCE	IR	3	2		

BHARAT HEAVY ELECTRICALS LTD
PROJECT ENGINEERING MANAGEMENT.

This approval status shall be interpreted as laid down in the contract and it shall not relieve the contractor from the contractual obligation.

APPROVAL CATEGORY AWARDED = I

CAT I - Approved
CAT II - Approved With Comments as Noted
CAT III - Not Approved
CAT IV - Reference Drawing

DEPARTMENT	MECHANICAL AUXILIARY
NAME: FALGUNI SAHA	20/12/2018

PARTICULARS	
NAME	
SIGNATURE	
DATE	

DE NORA INDIA LIMITED
Plot Nos: 184, 185 & 189, Kundaim Industrial Estate, Kundaim - 403115, Goa, India.

बी एच ई एल BHEL	QUALITY PLAN	**CLIENT:** BHEL, NEW DELHI	**PROJECT TITLE:**	2 X 660MW ENNORE SEZ COAL BASED SUPERCRITICAL THERMAL POWER	**END USER:** TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)
		VENDOR: DE NORA INDIA LIMITED	**QUALITY PLAN NO:**	PE-V11-412-174-A128A	
	Sheet **3** of **3**	**SYSTEM:** ELECTRO CHORINATION PACKAGE	**ITEM:**	VERTICAL MS+FRP TANK WITH TOP DISH & FLAT BOTTOM	

LEGEND DETAILS: P – Perform, W – Witness, V – Verify, 1 – BHEL/ TANGEDCO, 2 – De Nora India Ltd., 3 – Sub Vendor, IR – Inspection Report, TC – Test Certificate.

SR. NO.	COMPONENT & OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTEND OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORM	FORMAT OF RECORD	INSPECTION AGENCY			REMARKS
									P	W	R	
1	2	3	4	5	6	7	8	9	10			11
3.2.	COMPLETE TANK	DIMENSIONS & ORIENTATION OF NOZZLES	MAJOR	MEASUREMENT	100%	APPROVED DRAWING	APPROVED DRAWING	IR	3	2		
3.3.	COMPLETE TANK	WORKMANSHIP	MAJOR	VISUAL	100%	APPROVED DRAWING	FREE FROM VISUAL DEFECTS	IR	3	2	1	
3.4.	COMPLETE TANK	HYDRO TEST/ WATER FILL UP TEST	CRITICAL	WATER FILL UP TEST	100%	APPROVED DRAWING	NO LEAKAGE	IR	3	2		
3.5.	PAINTING & MARKING	PAINTING FINISH/ DFT ADHESION, UNIFORMITY & SHADE & IDENTIFICATION MARKING	MAJOR	VISUAL/ MEASUREMENT	100%	APPROVED GA DRAWING	APPROVED GA DRAWING	IR	3	2		

BHARAT HEAVY ELECTRICALS LTD
PROJECT ENGINEERING MANAGEMENT.

This approval status shall be interpreted as laid down in the contract and it shall not relieve the contractor from the contractual obligation.

APPROVAL CATEGORY AWARDED = I

CAT I - Approved
CAT II - Approved With Comments as Noted
CAT III - Not Approved
CAT IV - Reference Drawing

DEPARTMENT	MECHANICAL AUXILIARY
NAME: FALGUNI SAHA	20/12/2018

PARTICULARS
NAME
SIGNATURE
DATE

DE NORA INDIA LIMITED
Plot Nos: 184, 185 & 189, Kundaim Industrial Estate, Kundaim - 403115, Goa, India.

BHEL	QUALITY PLAN	**CLIENT:** BHEL, NEW DELHI	**PROJECT TITLE:**	2 X 660MW ENNORE SEZ COAL BASED SUPERCRITICAL THERMAL POWER	**END USER:** TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)
		VENDOR: DE NORA INDIA LIMITED	**QUALITY PLAN NO:**	PE-V11-412-174-A128A	
	Sheet 1 of 2	**SYSTEM:** ELECTRO CHORINATION PACKAGE	**ITEM:**	SELF CLEANING FILTER & SIMPLEX BASKET STRAINER	

LEGEND DETAILS: P – Perform, W – Witness, V – Verify, 1 – BHEL/ TANGEDCO, 2 – De Nora India Ltd., 3 – Sub Vendor, IR – Inspection Report, TC – Test Certificate.

SR. NO.	COMPONENT & OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTEND OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORM	FORMAT OF RECORD	INSPECTION AGENCY			REMARKS
									P	W	R	
1	2	3	4	5	6	7	8	9	10			11
1.	**RAW MATERIAL STAGE:**											
1.1.	PLATES, PIPES.	CHEMICAL & MECHANICAL ANALYSIS	MAJOR	REVIEW OF MTC	1 LOT	APPD. DRG / DATASHEET /SPEC	APPD. DRG / DATASHEET /SPEC	MILL/ LAB T.C.	3	3	2, 1	IN ABSENCE OF MILL TC, CHECK TEST TO BE CARRIED OUT.
1.2.		DIMENSIONAL & SURFACE DEFECT	MAJOR	VISUAL & MEASUREMENT	100%	-DO-	-DO-	IR	3	-	-	
1.3.	FLANGES, FITTING, FASTNERS	CHEMICAL & MECHANICAL ANALYSIS	MAJOR	REVIEW OF MTC	100%	APPROVED DATASHEET/ DRAWING	APPROVED DATASHEET/ DRAWING	T.C.	3		2, 1	
1.4.		DIMENSIONAL	MAJOR	MEASUREMENT	100%	-DO-		T.C.	3	-	-	
2.	**IN PROCESS**											
2.1.	WELDING PROCESS	WELDING PROCEDURE & PERFORMANCE QUALIFICATIONS	CR	VISUAL & RT/ MECH TEST ON TEST COUPON	100%	ASME SECT. IX	ASME SECT. IX	WPS, PQR, WPQ	3	3	2, 1	WPS, PQR, WPQ WILL BE SUBMITTED.
2.2.	SHELL FABRICATION	MARKING, EDGE PREPARATION, ROLLING & SET UP WITH TACK WELDING	MAJOR	DIMENSIONAL COMFORMITY & ROOT GAP	100%	APPROVED DRAWING / SPEC	APPROVED DRAWING / SPEC	IR	3	3	-	

BHARAT HEAVY ELECTRICALS LTD
PROJECT ENGINEERING MANAGEMENT.

This approval status shall be interpreted as laid down in the contract and it shall not relieve the contractor from the contractual obligation.

APPROVAL CATEGORY AWARDED = I

CAT I - Approved
CAT II - Approved With Comments as Noted
CAT III - Not Approved
CAT IV - Reference Drawing

DEPARTMENT	MECHANICAL AUXILIARY
NAME: FALGUNI SAHA	20/12/2018

	PARTICULARS	OTOKLIN
	NAME	
	SIGNATURE	
	DATE	

DE NORA INDIA LIMITED
Plot Nos: 184, 185 & 189, Kundaim Industrial Estate, Kundaim - 403115, Goa, India.

BHEL	QUALITY PLAN	**CLIENT:** BHEL, NEW DELHI	**PROJECT TITLE:**	2 X 660MW ENNORE SEZ COAL BASED SUPERCRITICAL THERMAL POWER	**END USER:** TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)
		VENDOR: DE NORA INDIA LIMITED	**QUALITY PLAN NO:**	PE-V11-412-174-A128A	
	Sheet 2 of 2	**SYSTEM:** ELECTRO CHORINATION PACKAGE	**ITEM:**	SELF CLEANING FILTER & SIMPLEX BASKET STRAINER	

LEGEND DETAILS: P – Perform, W – Witness, V – Verify, 1 – BHEL/ TANGEDCO, 2 – De Nora India Ltd., 3 – Sub Vendor, IR – Inspection Report, TC – Test Certificate.

SR. NO.	COMPONENT & OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTEND OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORM	FORMAT OF RECORD	INSPECTION AGENCY			REMARKS
									P	W	R	
1	2	3	4	5	6	7	8	9	10			11
2.3.	ALL BUTT WELD JOINTS	WELD QUALITY ON ROOT BACK GOUGING & FINAL RUN	MAJOR	VISUAL & DP TEST	100%	ASTM E165	NO RECORDABLE INDICATION	IR	3		2, 1	IR REPORT WILL BE SUBMITTED
3.	**FINAL ASSEMBLY**											
3.1.	BODY COMPLETE ASSLY. (WITHOUT D.P.T.)	FUNCTIONAL TEST (WITHOUT PROCESS FLUID) VISUAL, DIMENSIONAL	MAJOR	BY MEASUREMENT & VISUAL CHECK	100%	SPEC. & APPD. DRG	SPEC. & APPD. DRG	IR	3	2, 1	-	
3.2.	BODY	HYDRO TEST	MAJOR	VISUAL CHECK	100%	-DO-	(NO LEAKAGE)	IR	3	2, 1	-	TOTAL HOLD TIME 30 MINUTES
4.	**SURFACE PREPARATION & PAINTING**	SURFACE FINISH, ACID CLEANING	MAJOR	VISUAL	100%	APPD. DRG/ DATASHEET/ SPEC/ PAINTING PROCECURE	APPD. DRG/ DATASHEET/ SPEC/ PAINTING PROCECURE	IR	3	-	2, 1	PAINT INSPECTION REPORT TO BE SUBMITTED FOR REVIEW.
5.	VALVES, MOTOR, & CONTROL PANEL	VISUAL	MAJOR	VERIFICATION OF T.C. & VISUAL	100%	APPD. DRG/ DATASHEET/ SPEC	APPD. DRG/ DATASHEET/ SPEC	TC/ IR/ COC	3	-	2, 1	TC/ IR TO BE SUBMITTED FOR RECORDS

BHARAT HEAVY ELECTRICALS LTD
PROJECT ENGINEERING MANAGEMENT.

This approval status shall be interpreted as laid down in the contract and it shall not relieve the contractor from the contractual obligation.

APPROVAL CATEGORY AWARDED = I

~~CAT I - Approved~~
CAT II - Approved With Comments as Noted
CAT III - Not Approved
CAT IV - Reference Drawing

DEPARTMENT	MECHANICAL AUXILIARY
NAME: FALGUNI SAHA	20/12/2018

	PARTICULARS	OTOKLIN
	NAME	
	SIGNATURE	
	DATE	

DE NORA INDIA LIMITED
Plot Nos: 184, 185 & 189, Kundaim Industrial Estate, Kundaim - 403115, Goa, India.

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

REV	DATE	ALTERED: / CHECKED:	REV	DATE	ALTERED / CHECKED

APPROVED

STATUS : CONTRACT

JOB NO.: 412

BHARAT HEAVY ELECTRICALS LTD
PROJECT ENGINEERING MANAGEMENT.

This approval status shall be interpreted as laid down in the contract and it shall not relieve the contractor from the contractual obligation.

APPROVAL CATEGORY AWARDED = IV

CAT I - Approved
CAT II - Approved With Comments as Noted
CAT III - Not Approved
CAT IV - Reference Drawing

DEPARTMENT	MECHANICAL AUXILIARY
NAME: FALGUNI SAHA	

2017.12.08 10:24:40 +05'30'

2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

BHARAT HEAVY ELECTRICALS LIMITED

PROJECTS ENGINEERING MANAGEMENT, NOIDA.

BHEL DWG NO. PE – V11 – 412 – 174 – A129

DE NORA

SUB CONTRACTOR: DE NORA INDIA LIMITED KUNDAIM – GOA

ASSOCIATE PARTNER: DE NORA WATER TECHNOLOGIES, SINGAPORE BRANCH

LOA NO: PW/PE/PG/EN1/P–24/17 DATED: 22 APR 2017

DEPT.	CODE	SCALE	WEIGHT(KG)	REF DRG.	ITEM
--	A	–	–	–	–

ERECTION PROCEDURE

	NAME	SIGN	DATE
PREP	SN		
CHKD	PG		
APPD	RF		

DEPT.							CARD CODE	BHEL DOC. NO. PE - V11 - 412 - 174 - A129	REV 0
SIGN			N.A.						
DATE								NO. OF SHEETS 27 EXCLUDING COVER PAGE	

Table of Contents

1. SCOPE OF WORK

The scope of work covered by this specification is the erection on site of the steel structures, machinery, equipment and piping system of electro chlorination plant.

The scope of work includes unloading of the materials from trucks and trailers, their handling and storing, their subsequent pick up from the warehouse or storage yard to the pre-fabrication workshop and/or erection site, as well as erection activities and inspection and testing of the various plant components upon completion of erection.

Consumable materials for piping erection are supplied by De Nora and are included in the erection scope.

Also the erection contractor must bear obligations and charges, as specified hereinafter, in connection with the work at site of the equipment manufacturer specialist during set up, testing and commissioning of their equipment of machinery.

Furthermore, the erection contractor shall put at disposal of the commissioning team all the skilled personnel, workers, tools and equipment that are required during commissioning.

2. PRECONDITIONS

2.1. Civil works

The civil works are excluded from the scope of this specification.

Before beginning the different erection operations, the following checks shall be carried out:

- Conformity of the basements supporting equipment and steel structure dimensional and referential sizes, levels and levelling and conformity of the grouting holes.
- Conformity of the reservations provided for the crossing of the piping and the ventilation: dimensional and reference sizes.
- Conformity of the chain hoist run way: positioning of the UPN type beams, dimensional and reference sizes.
- Conformity of the trenches provided for the piping.

The general tolerances to be complied with for these checks are:

- dimensional and references sizes: -10 mm
  +20 mm
- piping wall penetration +/-25 mm

2.2. Erection of machinery and equipment

The following parts of the plant are classified as equipment:

- Electrolyser skid
- Hypochlorite Storage cum Degassing Tanks
- 5% HCl Preparation cum Acid Cleaning Tank
- Bulk Acid Storage Tank
- Hypochlorite Storage Tank with Accessories

They are usually delivered pre-assembled in parts of weight and/or dimensions considering the handling and transport conveniences.

The largest and heaviest sub-assembled part will be detailed in the drawings.

Pumps, motors, etc. are classified as machinery.

Instruments, valves and piping are delivered loose.

The contractor shall check the foundations and carryout the assembling of all the parts, as well as the erection, levelling and alignment of the equipment/machinery.

3. DOCUMENTATION

PE-V11-412-174-A101	Piping & Instrumentation Diagram
PE-V11-412-174-A103	Equipment Layout
PE-V11-412-174-A106	Civil Assignment DRAWING
PE-V11-412-174-A108	Piping Layout with diffuser installation
PE-V11-412-174-A116	Datasheet & GA of Hypochlorite generator (Electrolyser)
PE-V11-412-174-A118	GA of Atmospheric Tanks
PE-V11-412-174-A119	Mechanical Datasheet & GA for Strainers & Valves
PE-V11-412-174-A121	GA & Data sheet of Transfer Rectifier

4. REQUIRED TOOLS AND MATERIALS

4.1. List of tools for component assembly (normal tools)

- set of normal workshop equipment for steel components cutting, drilling, grinding and welding (support structures assembly)
- pneumatic impact wrenches
- dynamometric wrenches 0-10 kg x m
- dynamometric wrenches 0-20 kg x m
- set of socket wrenches
- set of double head wrenches
- set of pipe wrenches
- adjustable wrenches

- insulated pliers
- snips
- disk type milling cutter
- screw drivers
- temporary C clamps
- located dowel pins
- precision level
- spirit level
- precision squares
- straight edges
- Miscellaneous safety equipment: face shields, mono-goggles, gloves, etc.
- Measuring Tape
- Scale
- Cutting Blade and Cutting Machine
- Scrubber
- File
- Set of spanners
- Spirit Level
- Adjustable wrenches
- Right Angle
- PPE's
- Hammer

4.2. Tools for CPVC piping erection

Equipment for one worker

- diamond disc saw
- alternate saw
- blades type 118 B
- disk grinding machine
- disk for grinding machine
- blades
- scraper with handle
- rifled steel (or bronze) roller 15 mm diameter X 70 mm
- flat brushes: 70 mm, 50 mm, 30 mm
- rubber gloves
- acetone for tools cleaning

4.3. Handling equipment

The following lifting equipment shall be necessary:

Movable crane with extensible arm to handle skids and FRP tanks;

- Two (2) Generator Skid dimensions:
  Each XXXX mm (L) x XXXX mm (W) x XXXX mm (Height),
  Dry Weight = XXXX kg

- Two (2) Transformers/Rectifiers dimensions:
  Each XXXX mm (L) x XXXX mm (W) x XXXX mm (Height)
  Dry Weight = XXXX kg
- Two (2) Hypochlorite Storage cum Degassing Tanks:
  Each XXXX mm (L) x XXXX mm (W) x XXXX mm (Height),
  Dry Weight = XXXX kg
- 5% HCl Preparation cum Acid Cleaning Tank:
  Each XXXX mm (L) x XXXX mm (W) x XXXX mm (Height),
  Dry Weight = XXXX kg
- Bulk Acid Storage Tank:
  Each XXXX mm (L) x XXXX mm (W) x XXXX mm (Height),
  Dry Weight = XXXX kg
- Hypochlorite Storage Tank with Accessories:
  Each XXXX mm (L) x XXXX mm (W) x XXXX mm (Height),
  Dry Weight = XXXX kg

5. EXECUTION

5.1. Mechanical

For all equipment layouts refer to the following drawings:

PE-V11-412-174-A103	Equipment Layout
PE-V11-412-174-A106	Civil Assignment DRAWING

Seawater Strainer

Seawater Strainers shall be delivered completely assembled. The following operations shall be performed on field.

Mobile crane shall be used to unload the equipment onto machinery skates. The equipment shall be pushed and pulled into the building by means of a lift truck or other fixed pulling system. An improvised inclined plane shall be used to elevate the equipment onto the foundation plinth.

Toe jacks and crowbars shall be used to lower the equipment onto the foundation plinth. Levelling of the equipment shall be done with a spirit level gauge. When necessary, shims shall be used to ensure the proper sitting of equipment.

4pcs x MXX anchor bolts shall be used to fix the location of the seawater strainers.

For reference, see Seawater Strainer drawing.

Sea Water Booster Pump with Base Plate

The seawater booster pumps shall be delivered completely assembled on base plate. The following operations shall be performed on field.

Mobile crane shall be used to unload the equipment onto machinery skates. The equipment shall be pushed and pulled into the building by means of a lift truck

or other fixed pulling system. An improvised inclined plane shall be used to elevate the equipment onto the foundation plinth.

Toe jacks and crowbars shall be used to lower the equipment onto the foundation plinth. Levelling of the equipment shall be done with a spirit level gauge. When necessary, shims shall be used to ensure the proper sitting of equipment.

4pcs x MXX anchor bolts shall be used to fix the location of the seawater booster pumps.

For reference, see seawater booster pumps drawing.

Electrolyser Skids

All the equipment shall be delivered completely assembled. The following operations shall be performed on field.

Mobile crane shall be used to unload the equipment onto machinery skates. The equipment shall be pushed and pulled into the building by means of a lift truck or other fixed pulling system. An improvised inclined plane shall be used to elevate the equipment onto the foundation plinth.

Toe jacks and crowbars shall be used to lower the equipment onto the foundation plinth. Levelling of the equipment shall be done with a spirit level gauge. When necessary, shims shall be used to ensure the proper sitting of equipment.

4pcs x MXX anchor bolts shall be used to fix the location of the equipment skid.

For reference see Drwg PE-V11-412-174-A116 Electrolyser Skid Assembly GA.

Air Dilution Blower with base plate

The blowers shall be delivered completely assembled with base plate. The following operations shall be performed on field.

Mobile crane shall be used to unload the equipment onto machinery skates. The equipment shall be pushed and pulled into the building by means of a lift truck or other fixed pulling system. An improvised inclined plane shall be used to elevate the equipment onto the foundation plinth.

Toe jacks and crowbars shall be used to lower the equipment onto the foundation plinth. Levelling of the equipment shall be done with a spirit level gauge. When necessary, shims shall be used to ensure the proper sitting of equipment.

4pcs x MXX anchor bolts shall be used to fix the location of the Air Dilution Blower.

For reference, see air dilution blower drawing.

Dosing Pump with Base Plate

The dosing pumps shall be delivered completely assembled on base plate. The following operations shall be performed on field.

Mobile crane shall be used to unload the equipment onto machinery skates. The equipment shall be pushed and pulled into the building by means of a lift truck or other fixed pulling system. An improvised inclined plane shall be used to elevate the equipment onto the foundation plinth.

Toe jacks and crowbars shall be used to lower the equipment onto the foundation plinth. Levelling of the equipment shall be done with a spirit level gauge. When necessary, shims shall be used to ensure the proper sitting of equipment.

4pcs x MXX anchor bolts shall be used to fix the location of the dosing pumps

For reference, see dosing pumps drawing.

Acid Cleaning pump with Base Plate

The acid cleaning pump shall be delivered completely assembled on base plate. The following operations shall be performed on field.

Mobile crane shall be used to unload the equipment onto machinery skates. The equipment shall be pushed and pulled into the building by means of a lift truck or other fixed pulling system. An improvised inclined plane shall be used to elevate the equipment onto the foundation plinth.

Toe jacks and crowbars shall be used to lower the equipment onto the foundation plinth. Levelling of the equipment shall be done with a spirit level gauge. When necessary, shims shall be used to ensure the proper sitting of equipment.

4pcs x MXX anchor bolts shall be used to fix the location of the acid cleaning pumps.

For reference, see acid cleaning pumps drawing.

Acid transfer pump with Base Plate

The acid transfer pump shall be delivered completely assembled on base plate. The following operations shall be performed on field.

Mobile crane shall be used to unload the equipment onto machinery skates. The equipment shall be pushed and pulled into the building by means of a lift truck or other fixed pulling system. An improvised inclined plane shall be used to elevate the equipment onto the foundation plinth.

Toe jacks and crowbars shall be used to lower the equipment onto the foundation plinth. Levelling of the equipment shall be done with a spirit level gauge. When necessary, shims shall be used to ensure the proper sitting of equipment.

4pcs x MXX anchor bolts shall be used to fix the location of the acid transfer pumps.

For reference, see acid transfer pumps drawing.

Neutralization pit dewatering pump with Base Plate

The neutralization pit dewatering pump shall be delivered completely assembled on base plate. The following operations shall be performed on field.

Mobile crane shall be used to unload the equipment onto machinery skates. The equipment shall be pushed and pulled into the building by means of a lift truck or other fixed pulling system. An improvised inclined plane shall be used to elevate the equipment onto the foundation plinth.

Toe jacks and crowbars shall be used to lower the equipment onto the foundation plinth. Levelling of the equipment shall be done with a spirit level gauge. When necessary, shims shall be used to ensure the proper sitting of equipment.

4pcs x MXX anchor bolts shall be used to fix the location of the neutralization pit dewatering pumps.

For reference, see neutralization pit dewatering pump drawing.

Hypochlorite Dosing Pump at Seawater Intake with Base Plate

The hypochlorite dosing pump at seawater intake shall be delivered completely assembled on base plate. The following operations shall be performed on field.

Mobile crane shall be used to unload the equipment onto machinery skates. The equipment shall be pushed and pulled into the building by means of a lift truck or other fixed pulling system. An improvised inclined plane shall be used to elevate the equipment onto the foundation plinth.

Toe jacks and crowbars shall be used to lower the equipment onto the foundation plinth. Levelling of the equipment shall be done with a spirit level gauge. When necessary, shims shall be used to ensure the proper sitting of equipment.

4pcs x MXX anchor bolts shall be used to fix the location of the hypochlorite dosing pump at seawater intake.

For reference, see hypochlorite dosing pump at seawater intake drawing.

Tanks

Handling FRP products

FRP has a high strength but, compared with steel products, a low toughness, and lightweight and therefore care should be taken in handling. Some precautionary measures;

- Never roll or slide the vessel. Lift the vessel using a crane.
- Never allow the equipment to swing out of control. Use a guideline to keep the load under control.
- Do not drop or allow hard impact from tools, spreader bars, etc., to the external or internal surfaces of the vessel.
- Never use cables or chains around the vessel. Always use nylon or canvas slings that are appropriate for the load.

Loading and unloading (ref. document; SKETCH 1B- Tank lifting)

Caution on cargo handling by crane

a) Canvas slings must be used at lifting lugs provided.

b) Lifting must be made by shackle and sling eye splice. Be careful not to squeeze the cargo by sling.

c) One point lifting and/or transverse slinging should not be done in any case.

Shifting and transportation

It is recommended to ship the products to destination in the original packages used for the delivery.

In particular, when FRP vessels have to be delivered by means of trucks, the use of shock absorbers on the contact surface is recommended to avoid damage of the equipment eventually provoked by the swinging of the truck.

When the FRP vessels have to be lifted by forklift, it is recommended to use suitable slippers and/or skids in order to avoid direct contact of the forklift, and to avoid concentration of load on the vessels.

In order to protect FRP vessels, nozzles and other accessories it is recommended not to hang ropes and not to exert a considerable stress on them.

Never pull the vessels by hand ropes fixed on the nozzles.

When loading/unloading vessels on a truck, it is necessary to avoid rotation so as to prevent damages on the nozzles.

Moreover, since FRP is light-weighted it is recommended to properly strap down the equipment in order to prevent any movement.

Lifting and erection

Two cranes shall be used for the erection of the vessel. One crane is to be equipped with a spreader bar and the 2nd cranes should be employed for lifting/hanging purpose.

Care should be taken to balance the weight of the equipment when it is hang at two points.

When lifting the equipment nylon rope slings – to be used as sack nets around the shell (as shown in the attached sketch 1B) – should be utilized.

The wire ropes can be exceptionally used, provided that some suitable shock absorbers are wound on the surface of FRP vessels that is in contact with the rope, to avoid scratches.

When lifting FRP vessels, care should be taken to avoid rope moving away from the original lifting point. It is recommended to carefully balance the weight of the equipment to avoid slippage and unexpected movement.

While lifting FRP vessels, care should be taken to avoid impact against any

object. Guide rope must be used to control the movement and swinging of the vessel.

For reference, refer to the attached Sketch 1B on Tank lifting.

Installation of tanks

The following operations have to be carried out:

1) mark the main axis on the vessel and the main axis on foundation;
2) check the elevation of foundation;
3) erect the vessel on the foundation and check the orientation (the main axis of the vessel have to match the main axis of foundation);
4) Check the verticality of the vessel. If the result cannot satisfy the installation standard, it should be adjusted by some metallic spacer between the legs and foundation.
5) XX pcs of MXX anchor bolts are used to anchor down to prevent toppling of the vessel during erection caused by wind or accidental impact, the vessel has to be hanged by crane until the fixing operations are completed.

Refer documents;

- GA of Atmospheric Tanks (PE-V11-412-174-A118)

Piping and Accessories

Rain shield, cat ladles, access platform and piping must be laid after the vessel has been installed and fixed properly. Piping should not be lifted by hanging ropes on the nozzles of FRP vessel.

Heavy fittings and valves, attached to the nozzles, should be independently supported by brackets in order to keep the nozzles free from loads.

Pipe supports

De Nora will supply partially pre-assembled structures such as saddles and guides, and a minimum of non-pre-assembled structures such as plates, shapes and beams in commercial length. The fabrication of the supports shall be carried out by the contractor on field.
Piping supports will be placed in the plant in compliance with the Drwg.

Piping support installation.

All pipe support installation shall be in accordance to pipe support drawing.

Safety shower/eyewash

All equipment shall be delivered completely assembled. This equipment can be handled by two men.
The equipment shall be positioned on top of the foundation plinth. Levelling

of the equipment shall be done with a spirit level gauge. When necessary, shims shall be used to ensure the proper sitting of equipment.

4pcs of MXX bolts shall be used to bolt down the location of the equipment.

5.2. Electrical

Transformer and Rectifier

All the equipment shall be delivered completely assembled. The following operations shall be performed on field.

Mobile crane shall be used to unload the equipment onto machinery skates. The equipment shall be pushed and pulled into the building by means of a lift truck or other fixed pulling system.

Toe jacks and crowbars shall be used to lower the equipment. Levelling of the equipment shall be done with a spirit level gauge. When necessary shims, shall be used to ensure the proper sitting of equipment

X pcs x MXX anchor bolts shall be used to clamp down the location of the equipment.

For reference see Drwg PE-V11-412-174-A121 GA & Data sheet of Transfer Rectifier

6. CHECK LIST

PUMPS / BLOWERS / STRAINERS

Pos.	Tests	
1	Checking of foundation dimensions	
2	Checking of positioning and level	
3	Check alignment	
4	Check anchor bolts	
5	Check electrical grounding	

ELECTROLYZER SKID

Pos.	Tests	
1	Checking of foundation dimensions	
2	Checking of positioning	
3	Check alignment	
4	Check anchor bolts	
5	Check electrical grounding	

TANKS

Pos.	Tests	
1	Checking of foundation dimensions	
2	Checking of nozzle orientation after placing	
3	Checking chemical anchor bolts	

PIPING ARRANGEMENT

Pos.	Tests	
1	Install piping according to piping layout dwgs.	
2	Fit up, align and inspect before joining with adjacent lines	
3	Fit up with equipment skid	
4	Hydraulic test	

TRANSFORMER RECTIFIER SKID

Pos.	Tests	
1	Checking of foundation dimensions	
2	Checking of positioning	
3	Check alignment	
4	Check anchor bolts	
5	Check electrical grounding	
6	Check DC cable & support	
7	Check cable markings	
8	Check cables are neatly laid and correctly terminated & glanded.	
9	Ensure proper ventilation for the transformer rectifier available	

PIPE SUPPORTS

Pos.	Tests	
1	Check the piping according to supports detail	
2	Fit up, position and piping alignment, check before erection	
3	Final inspection after erection	

A N N E X 1

SPECIFICATION FOR THE EXECUTION OF CPVC PIPING AND CONNECTIONS.

JOINING METHODS

Basic Principles of Solvent Cementing

To make consistently tight joints, the following points should be clearly understood:

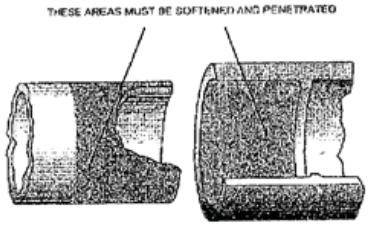
1. The joining surfaces must be softened and made semi-fluid.
2. Sufficient cement must be applied to fill the gap between pipe and fittings.
3. Assembly of pipe and fittings must be made while the surfaces are still wet and fluid.
4. Joint strength develops as the cement dries. In the tight part of the joint, surfaces tend to fuse together; in the loose part, the cement bonds to both surfaces.

Penetration and softening can be achieved by the cement itself, by a suitable primer, or by the use of both primer and cement. A suitable primer will usually penetrate and soften the surfaces more quickly than cement alone. In addition, the use of a primer provides a safety factor for the installer. For example, in cold weather, more time and additional applications of the solvent are required.

Apply generous amounts of cement to fill the loose part of the joint. In addition to filling the gap, adequate cement layers will penetrate the surfaces and remain wet until the joint is assembled. To prove this, apply two separate layers of cement on the top surface of a piece of pipe. First, apply a heavy layer of cement; then beside it, a thin, brushed-out layer. Test the layers every 15 seconds by gently tapping with your finger. You will note that the thin layer becomes tacky and then dries quickly (probably within 15 seconds). The heavy layer will remain wet much longer. Check for penetration a few minutes after applying these layers by scraping them with a knife. The thin layer will have little or no penetration, while the heavy layer will have more penetration.

If the cement coatings on the pipe and fittings are wet and fluid when assembly takes place, they tend to flow together, becoming one cement layer. Also, if the cement is set, the surfaces beneath the pipe and fittings will still be soft. These softened surfaces in the tight part of the joint will fuse together.

As the solvent dissipates, the cement layer and the softened surfaces will harden with a corresponding increase in joint strength. A good joint will withstand the required working pressure long before the joint is fully dry and final strength is obtained. In the tight (fused) part of the joint, strength will develop quicker than in the looser (bonded) part of the joint.



SOLVENT CEMENTING INSTRUCTIONS FOR PVC & CPVC PIPE & FITTINGS

Handling

Solvent cements should be used as received in original containers. Adding thinners to change the viscosity of cement is not recommended. If cement is jelly-like and not free-flowing, it should not be used. Containers should be kept tightly covered when not in use to stop the evaporation of the solvent.

Storage Conditions

Solvent cements should be stored at temperatures between 40°F and 110°F away from heat or open flame. Cements should be used before the expiry date stamped on the container. If new cement is subjected to freezing temperatures, it may become extremely thick or gelled. This cement can be placed in a warm area where it will soon return to its original, usable condition. However, if hardening is due to actual solvent loss (when a container is left open too long during use or not sealed properly after use), the cement will not return to its original condition. Cement in this condition has lost its formulation and should be discarded in an environmentally safe manner.

Safety Precautions

Solvent cements are extremely flammable and should not be used or stored near heat or open flame. In confined or partially enclosed areas, a ventilating device should be used to remove vapors and minimize inhalation. Containers should be kept tightly closed when not in use, and covered as much as possible when in use. Avoid frequent contact with the skin. In case of eye contact, flush repeatedly with water. Keep out of the reach of children.

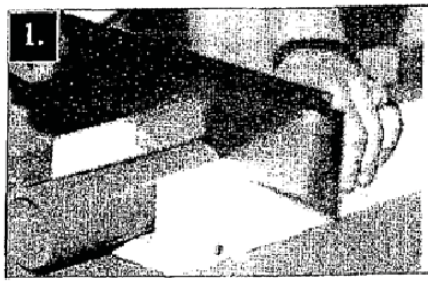
Cold Weather

Although normal installation temperatures are between 40°F and 110°F, high strength joints have been made at temperatures as low as –15°F with the cements listed on Page 39. However, the installer must ensure he has adequately softened the joining surfaces as outlined in the following steps 7 through 11 of this manual. In addition, cement must be kept warm to prevent excessive thickening and gelation in cold weather.

INSTALLATION PROCEDURES

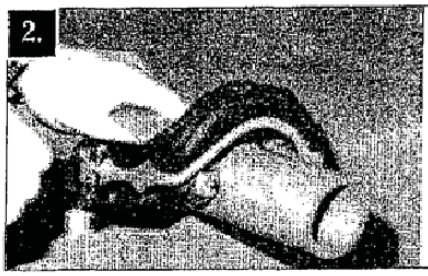
Preparation

1.



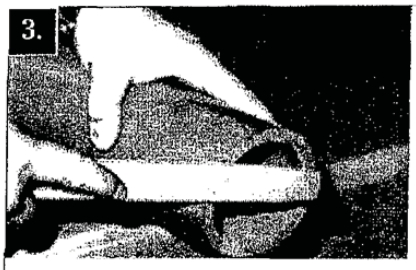
Use a handsaw and mitre box or mechanical saw to cut squarely. A diagonal cut reduces the bonding area in the most effective part of the joint.

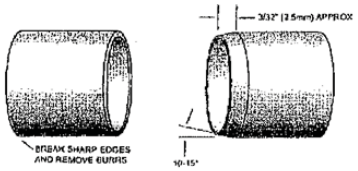
2.



Plastic tube cutters may also be used for cutting plastic pipe. However, some cutters produce a raised bead at the end of the pipe. This must be removed with a file or reamer, as it will wipe the cement away when pipe is inserted into the fitting.

3.





Use a knife, plastic pipe deburring tool, or file to remove burrs from the end of small diameter pipe. Be sure to remove all burrs from around the inside as well as the outside of the pipe. A slight chamfer (bevel) of about 10° - 15° should be added to the end to permit easier insertion of the pipe into the fitting. Failure to chamfer the edge of the pipe may remove cement from the fitting socket, causing the joint to leak. For pressure pipe systems of 2" and above, the pipe must be end-treated with a 15° chamfer cut to a depth of approximately 3/32".

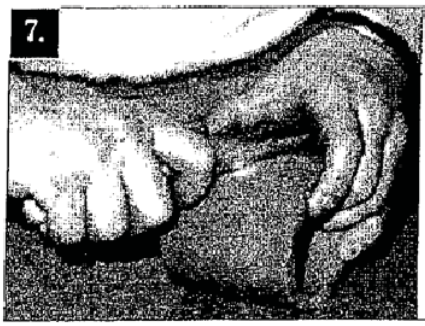
4. Remove dirt, grease and moisture; a thorough wipe with a clean dry cloth is usually sufficient. Moisture will retard cure, and dirt or grease can prevent adhesion. Solvent cementing should not be attempted in the rain.

5.

Check pipe and fittings for fit (dry) before cementing. For proper interference fit, the pipe must go easily into the fittings one-third to three-quarters of the way. Too tight a fit is not desirable. You must be able to fully bottom the pipe in the socket during assembly with cement. If the pipe and fittings are not out of round, a satisfactory joint can be made if there is a "net" fit, i.e. the pipe bottoms in the fitting socket with no interference, but without excess movement.

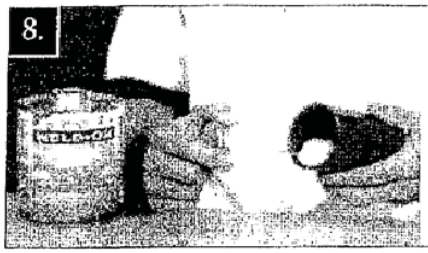
6. Use the right applicator for the size of pipe or fittings being joined: for pipe sizes 3/8" through 1" use the 3/4" dauber; for sizes 3/4" through 2" the BCP-1" brush; 3/4" through 3" the 1 1/2" dauber; 3" through 24", use a roller or paintbrush about one-half the pipe diameter being cemented. It is important that the correct size applicator be used to ensure that sufficient layers of cement are applied.

Priming



7. The purpose of the primer is to penetrate and soften the pipe and fitting surfaces so that they can be fused. The proper use of the primer and the checking of its softening effect provides assurance that the surfaces are prepared for fusion in a wide variety of conditions.

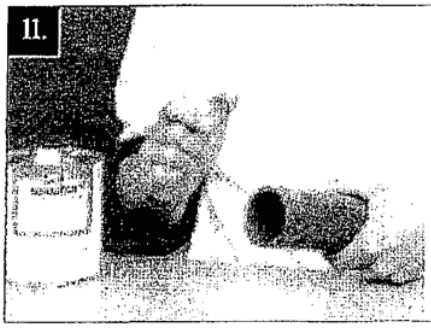
Also, always check the penetration or softening on a piece of scrap pipe before you start the installation, and if the weather changes during the installation process. Using a knife or sharp scraper, draw the edge over the coated surface. Proper penetration has been made if you can scrape away a few thousandths of an inch of the primed surface. As weather conditions affect priming and cementing action, repeated applications to one or both surfaces may be necessary. In cold weather, more time is required for proper penetration.



8. Using the correct applicator (as outlined in step 6), apply primer freely to the fitting socket, keeping the surface and applicator wet until the surface has been softened. This will usually take 5–15 seconds. More time is needed for hard surfaces and cold weather conditions. Redip the applicator in primer as required. When the surface is primed, remove any puddles of primer from the socket of the fitting.

9. Apply the primer to the spigot end equal to the depth of the fitting socket. Use the same method of application used in step 8.

10. A second application in the socket is recommended if it has unusually hard surfaces, often found in bell-ends and in fittings made from pipe stock. They also can occur in some molded fittings.



11. Immediately, and while surfaces are still wet, apply appropriate cement. The correct cement for the job can be quickly determined by reading the container labels. Be sure that the cement is in a fluid condition. If it is thicker than normal or appears gel-like or ropey, it should not be used.

⚠ CAUTION

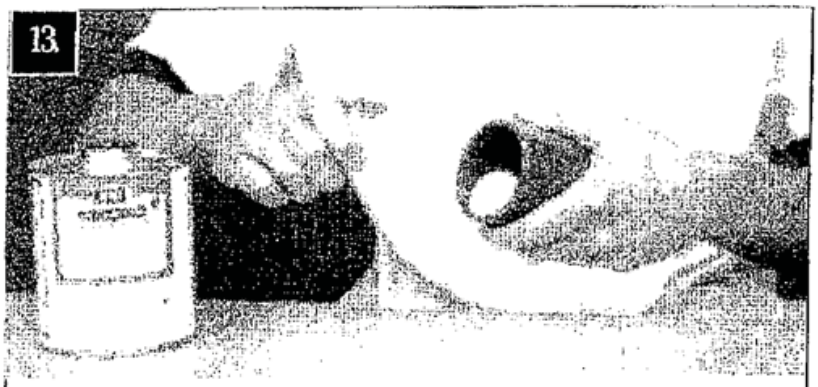
Primers and cements are extremely flammable, and must not be stored or used near heat or open flame. Read all warnings on primer and cement cans.

NOTE: **All solvent-welded PVC or CPVC systems should be filled and/or flushed with water immediately after installation and curing to remove all flammable cement vapors.** Failure to flush a new line leaves a dangerous potential for inadvertent ignition of any residual cement vapors.

Cementing

12. Stir the cement and apply as is, using the correct applicator (outlined in step 6). Apply a thick, even layer of cement on the pipe, equal to the depth of the socket. Flow the cement on with the applicator. DO NOT brush it out to a thin layer which will dry in a few seconds.

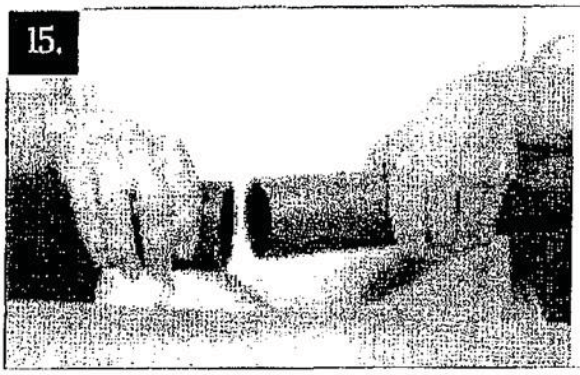
13.



Apply a medium layer of cement to the fitting socket; avoid puddling cement in the socket. On bell-end pipe, do not coat beyond the socket depth or allow cement to run down in the pipe beyond the bell.

14. Apply a second thick, even layer of cement on the pipe where a sizable gap exists between pipe and fitting. There must be more than sufficient cement to fill any gap in the joint. Large-sized pipe and fittings may require two or more men to apply the primer and cement, and assemble the pipe and fitting.

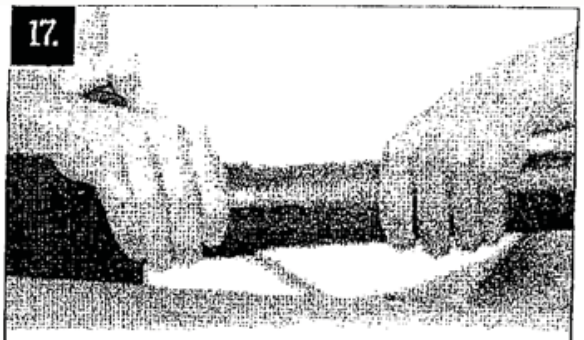
15.



Attach the pipe to the fitting without delay. Cement must be wet. Use sufficient force to ensure that the pipe bottoms into the fitting socket. If possible, twist the pipe one-eighth to one-quarter turn as it is inserted.

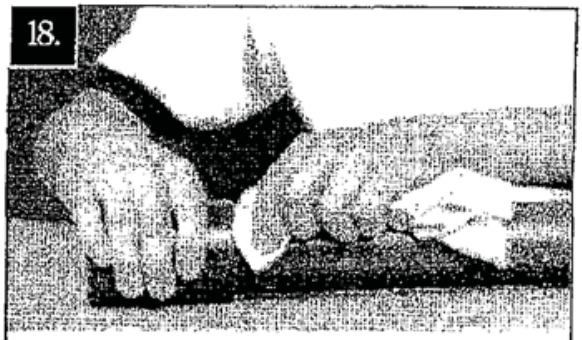
16. Hold the pipe and fitting together for a short time (5–30 seconds) to eliminate pushout. Larger sizes with tight fits may require more time. Since the fitting sockets are made with a taper, the pipe may move back out of the fittings just after assembly.

17.



A joint will have a ring or bead of cement completely around the juncture of the pipe and fitting after assembly. If voids in this ring are present, insufficient cement was applied and the joint may be defective.

18.



Using a cloth, remove all excess cement from the pipe and fitting, including the ring or bead, as it will needlessly soften the pipe and fitting, and does not add to joint strength.

19. Handle newly assembled joints carefully until initial set has taken place. Recommended setting time allowed before handling or moving is related to temperature.

20. Joint strength development is very rapid within the first 48 hours. Short cure periods are satisfactory for high ambient temperatures with low humidity, small pipe sizes and interference-type fittings. Longer cure periods are necessary for low temperatures, large pipe sizes, loose fits and relatively high humidity.

Notes:

1. For solvent cementing 8" and larger pipe and fittings, the following is recommended:
   a. Two operators are needed, simultaneously applying primer and cement to pipe and fittings.
   b. An extra-heavy, high-strength cement is recommended. It provides thicker layers and has a higher gap-filling property. It also allows slightly more open time before assembly.
   c. A mechanical device may be needed to pull the joint together. This may be as simple as a 2x4 and a bar, or another method is to use two "come-alongs" or lever pullers. Sufficient chain with a choker strap is laid out on either side of the joint. The "come-alongs" are then laid out on either side of the joint, adjusted to the correct length, equivalent to the insertion depth. The primer and cement are applied; the "come-alongs" are immediately hooked up, and the joint pulled together.
2. Heavy-bodied, medium-setting, high-strength cements are suitable for all schedules and classes of pipe. It is normally used for pipe sizes to 12" but may be suitable for larger thin-walled pipe if it has an interference fit and if the gap between the pipe and fitting is not larger than 1/32".

CEMENTING

Initial Set Time

AVERAGE INITIAL SET SCHEDULE
FOR PVC & CPVC SOLVENT CEMENTS*

Temp. Range	Pipe Size 1/2"-1 1/4"	Pipe Size 1 1/2"-2"	Pipe Size 2 1/2"-6"	Pipe Size 10"-15"	Pipe Size 15"+
60° – 100°F	2 min.	5 min.	30 min.	2 hrs.	4 hrs.
40° – 60°F	5 min.	10 min.	2 hrs.	8 hrs.	16 hrs.
0° – 40°F	10 min.	15 min.	12 hrs.	24 hrs.	48 hrs.

NOTE: Initial set schedule is the necessary time to allow before the joint can be carefully handled.

*These figures are estimates based on our laboratory tests. Due to the many variables in the field, these figures should be used as a general guide only.

After initial set, the joints will withstand the stresses of a normal installation. (A misaligned installation will cause excessive stresses in the joint.) For long runs of pipe, care should be taken not to disturb joints for 1/2 to 1 1/2 hours before handling or burying. In damp or humid weather and chemical applications, allow a minimum of 50% more set time.

Joint Cure Schedule

The following cure schedules may be used to determine the necessary time required after assembly before testing the system or before line pressure can be applied.

up to 6" PVC 40 All types
Medium-bodied fast-setting cement.

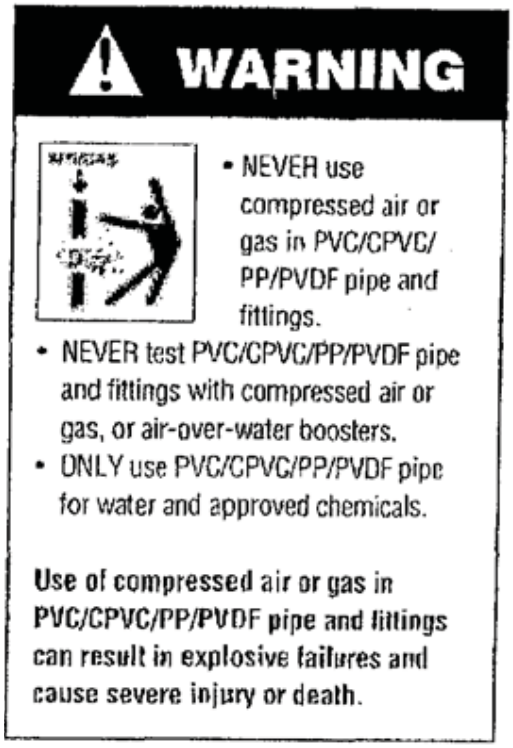
RELATIVE HUMIDITY — AVERAGE JOINT CURE SCHEDULE FOR PVC & CPVC SOLVENT CEMENTS**

60% or less	1/2" – 1 1/4"		1 1/2" – 2"		2 1/2" – 8"		10" – 15"	15" +
Temp. Range During Assembly and Cure Periods	up to 160 psi	above 160 – 370 psi	up to 160 psi	above 160 – 315 psi	up to 160 psi	above 160 – 315 psi	up to 100 psi	up to 100 psi
60° – 100°F	15 min.	6 hrs.	30 min.	12 hrs.	1 1/2 hrs.	24 hrs.	48 hrs.	72 hrs.
40° – 60°F	20 min.	12 hrs.	45 min.	24 hrs.	4 hrs.	48 hrs.	96 hrs.	6 days
0° – 40°F	30 min.	48 hrs.	1 hr.	96 hrs.	72 hrs.	8 days	8 days	14 days

NOTE: Joint cure schedule is the necessary time to allow before pressurizing system. In damp or humid weather and chemical applications, allow a minimum of 50% more cure time.
**These figures are estimates based on our laboratory tests. Due to the many variables in the field, these figures should be used as a general guide only.

Average Number of Joints Per Quart of Cement

Pipe Diameter	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	4"	6"	8"	10"	12"	14"	16"
Number of Joints	300	200	125	120	90	60	45	40	30	10	5	2-3	1-2	¾	½


WARNING
• NEVER use compressed air or gas in PVC/CPVC/ PP/PVDF pipe and fittings.
• NEVER test PVC/CPVC/PP/PVDF pipe and fittings with compressed air or gas, or air-over-water boosters.
• ONLY use PVC/CPVC/PP/PVDF pipe for water and approved chemicals.
Use of compressed air or gas in PVC/CPVC/PP/PVDF pipe and fittings can result in explosive failures and cause severe injury or death.

A N N E X 2
RECOMMENDED BOLT TORQUE AND TORQUE SEQUENCE FOR THERMOPLASTIC FLANGES

Schedule 80 CPVC Technical Information

CPVC Pipe Flange Dimensions & Information

Bolt Kit Selection Guide

Bolt Hardware Kits Available
For Connection of 2-Spears® Flanges
Includes Bolts, Nuts & Flat Washers for Specified Flange Size
Order Gaskets & Bolt Kits Separately
- Pre-coated, Anti-seize Lubricated Bolts
- Available in Zinc Coated Steel, Type 316 Stainless Steel or Type 304 Stainless Steel

Flange Size	Bolts* Per Kit	Diameter (in.-TPI)	Length (in.)	Kit Part Number		
				Zinc	316 SS	304 SS
1/2 & 3/4	4	1/2 - 13	2	HK-005	HK1-005	HK2-005
1 & 1-1/4	4	1/2 - 13	2-1/4	HK-010	HK1-010	HK2-010
1-1/2	4	1/2 - 13	2-1/2	HK-015	HK1-015	HK2-015
2	4	5/8 - 11	3	HK-020	HK1-020	HK2-020
2-1/2	4	5/8 - 11	3-1/4	HK-025	HK1-025	HK2-025
3	4	5/8 - 11	3-1/2	HK-030	HK1-030	HK2-030
4	8	5/8 - 11	3-1/2	HK-040	HK1-040	HK2-040
5 & 6	8	3/4 - 10	4	HK-060	HK1-060	HK2-060
8	8	3/4 - 10	4-1/2	HK-080	HK1-080	HK2-080
10 & 12	12	7/8 - 9	5	HK-120	HK1-120	HK2-120

* Each Bolt Includes Nut & Two (2) Flat Washers

Bolt Torque

Recommended Bolt Torque is shown in **Table 1.** Threads should be clean and well lubricated. Actual field conditions may require variations in these recommendations. **CAUTION: UNNECESSARY OVER TORQUING WILL DAMAGE THE FLANGE.**

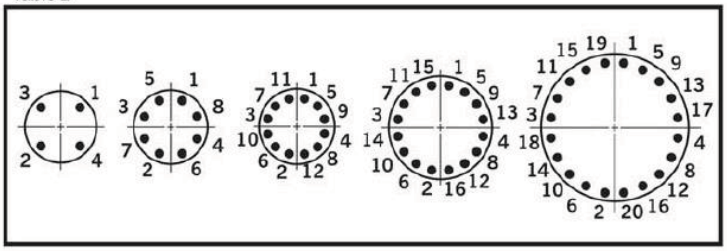
Table 1

Flange Size (in.)	Recommended Torque (ft. lbs.)
1/2 - 1-1/2	12
2 - 4	25
5	30
6 - 8	40
10	64
12	95
14 - 24	110

Torque Sequence

Bolt Torque sequence is shown Below in **Table 2.**

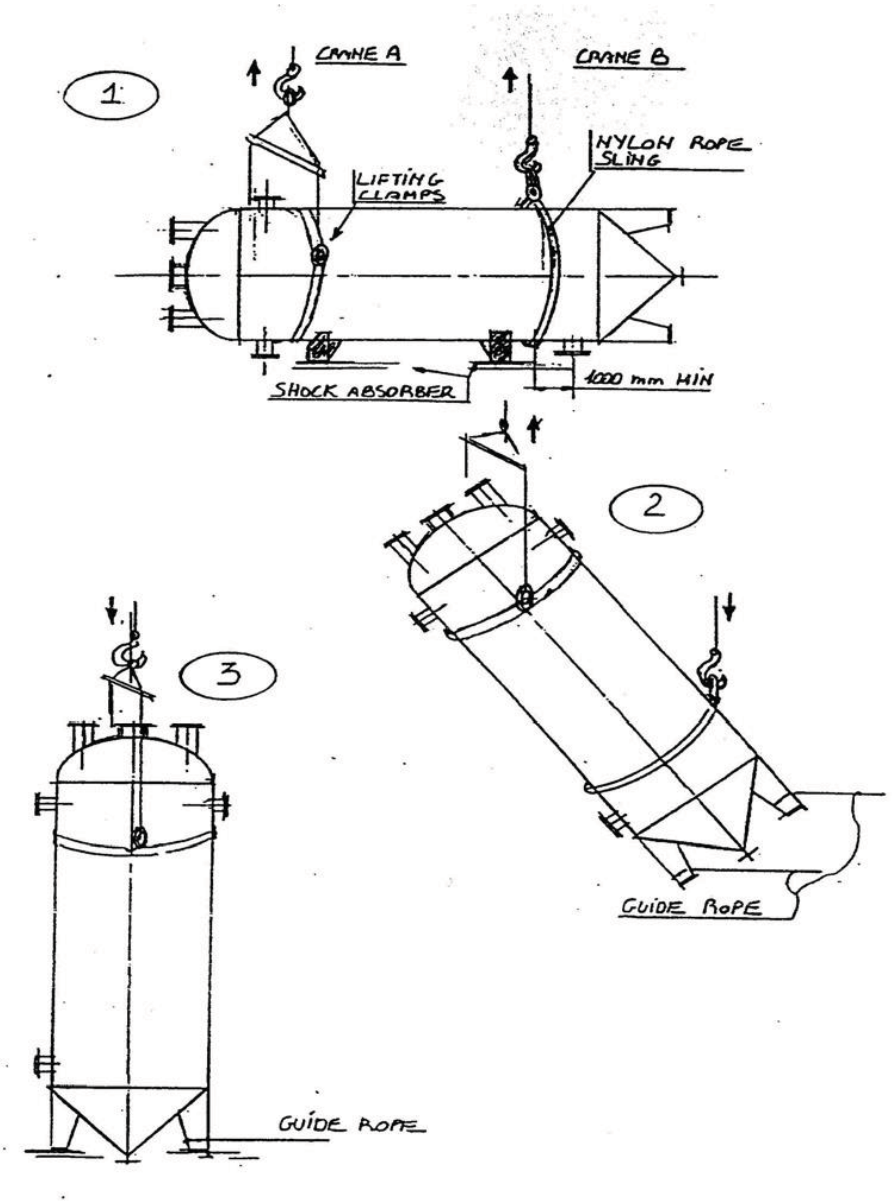
Table 2



S K E T C H 1A
ELECTROLYZER SKIDS LIFTING SKETCH

Typical for Lifting skids

S K E T C H 1B
TANKS LIFTING SKETCH


1
CRANE A
CRANE B
NYLON ROPE SLING
LIFTING CLAMPS
SHOCK ABSORBER
1000 mm MIN
2
GUIDE ROPE
3
GUIDE ROPE

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

REV	DATE	ALTERED: / CHECKED:	REV	DATE	ALTERED: / CHECKED:

INFORMATION ONLY

STATUS : CONTRACT

JOB NO.: 412

BHARAT HEAVY ELECTRICALS LTD
PROJECT ENGINEERING MANAGEMENT.

This approval status shall be interpreted as laid down in the contract and it shall not relieve the contractor from the contractual obligation.

APPROVAL CATEGORY AWARDED = IV

CAT I - Approved
CAT II - Approved With Comments as Noted
CAT III - Not Approved
CAT IV - Reference Drawing

DEPARTMENT	MECHANICAL AUXILIARY
NAME: FALGUNI SAHA	2019

2019.12.03 12:32:30 +05'30'

2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

BHARAT HEAVY ELECTRICALS LIMITED

PROJECTS ENGINEERING MANAGEMENT, NOIDA.

BHEL DWG NO. PE-V11-412-182-A138

SUB CONTRACTOR: DE NORA INDIA LIMITED
KUNDAIM - GOA

ASSOCIATE PARTNER: DE NORA WATER TECHNOLOGIES,
SINGAPORE BRANCH

LOA NO: PW/PE/PG/EN1/P-24/17 DATED:24 OCT 2019

DEPT.	CODE	SCALE	WEIGHT(KG)	REF DRG.	ITEM
--	A	-	-	-	-

CAUSE AND EFFECT CHART FOR ELECTROCHLORINATION PLANT

	NAME	SIGN	DATE
PREP	V.YONG		
CHKD	K.TAY		
APPD	D.TAN		

DEPT.							CARD CODE	DRAWING NO.	REV
SIGN			N.A.				-	PE-V11-412-174-A138	0
DATE								NO. OF SHEETS 2 EXCLUDING COVER PAGE	

EFFECT / CAUSE		SEAWATER BOOSTER PUMP				FLOW CONTROL VALVE				TRANSFORMER RECTIFIER				ON/OFF VALVE				HYPO DOSING PUMP																AIR BLOWER								ACID CLEANING PUMP												
		SEAWATER BOOSTER PUMP A	SEAWATER BOOSTER PUMP A	SEAWATER BOOSTER PUMP B	SEAWATER BOOSTER PUMP B	SODIUM HYPOCHLORITE GENERATOR A INLET F/V	SODIUM HYPOCHLORITE GENERATOR A INLET F/V	SODIUM HYPOCHLORITE GENERATOR B INLET F/V	SODIUM HYPOCHLORITE GENERATOR B INLET F/V	TRANSFORMER/RECTIFIER A	TRANSFORMER/RECTIFIER A	TRANSFORMER/RECTIFIER B	TRANSFORMER/RECTIFIER B	SODIUM HYPOCHLORITE GENERATOR A OUTLET X	SODIUM HYPOCHLORITE GENERATOR A OUTLET X	SODIUM HYPOCHLORITE GENERATOR B OUTLET X	SODIUM HYPOCHLORITE GENERATOR B OUTLET X	CONTINUOUS HYPO DOSING PUMP A	CONTINUOUS HYPO DOSING PUMP A	CONTINUOUS HYPO DOSING PUMP B	CONTINUOUS HYPO DOSING PUMP B	SHOCK HYPO DOSING PUMP A	SHOCK HYPO DOSING PUMP A	SHOCK HYPO DOSING PUMP B	SHOCK HYPO DOSING PUMP B	SHOCK HYPO DOSING PUMP C	SHOCK HYPO DOSING PUMP C	CONTINUOUS HYPO DOSING PUMP A to PTP	CONTINUOUS HYPO DOSING PUMP A to PTP	CONTINUOUS HYPO DOSING PUMP B to PTP	CONTINUOUS HYPO DOSING PUMP B to PTP	AIR BLOWER A (DEGASSING TANK A)	AIR BLOWER A (DEGASSING TANK A)	AIR BLOWER B (DEGASSING TANK A)	AIR BLOWER B (DEGASSING TANK A)	AIR BLOWER A (DEGASSING TANK B)	AIR BLOWER A (DEGASSING TANK B)	AIR BLOWER A (DEGASSING TANK B)	AIR BLOWER A (DEGASSING TANK B)	ACID CLEANING PUMP A	ACID CLEANING PUMP A	ACID CLEANING PUMP B	ACID CLEANING PUMP B					
	ACTION	START	STOP	START	STOP	OPEN	CLOSE	OPEN	CLOSE	START	STOP	START	STOP	OPEN	CLOSE	OPEN	CLOSE	START	STOP	START	STOP	START	STOP	START	STOP	START	STOP	START	STOP	START	STOP	START	STOP	START	STOP	START	STOP	START	STOP	START PERMISSIVE	STOP	START PERMISSIVE	STOP					
	DEVICE	00PBM21AP001	00PBM21AP001	00PBM22AP001	00PBM22AP001	00PBM31AA601	00PBM31AA601	00PBM32AA601	00PBM32AA601	00PBM31GT001	00PBM31GT001	00PBM32GT001	00PBM32GT001	00PBM31AA602	00PBM31AA602	00PBM32AA602	00PBM32AA602	00PBM41AP001	00PBM41AP001	00PBM42AP001	00PBM42AP001	00PBM43AP001	00PBM43AP001	00PBM44AP001	00PBM44AP001	00PBM45AP001	00PBM45AP001	00PBM46AP001	00PBM46AP001	00PBM47AP001	00PBM47AP001	00PBM47ANJ01	00PBM47ANJ01	00PBM48ANJ01	00PBM48ANJ01	00PBM49ANJ01	00PBM49ANJ01	00PBM50ANJ01	00PBM50ANJ01	00PBM52AP001	00PBM52AP001	00PBM53AP001	00PBM53AP001					REMARKS
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45		
Start-up Sequence (Tank empty) / START pushbutton	1	X				X								X																		X			X												1	
LIT (DEGASSING TANK A & B) ≥ 20%	2									X																																				2	
LIT (DEGASSING TANK A & B) ≥ 55% (Note 1)	3																	X				X6		X6				X																		3	
STOP pushbutton pressed from HMI	8		X1		X1		X1		X1		X		X		X1		X1		X1		X1		X1		X1		X1		X1		X1		X1		X1		X1		X		X					8	
	9																																														9	
SEAWATER BOOSTER PUMP 00PBM21AP001 TRIP/FAULT FROM MCC	10			X																																										10	
SEAWATER BOOSTER PUMP 00PBM22AP001 TRIP/FAULT FROM MCC	11	X																																													11	
SODIUM HYPOCHLORITE GENERATOR A INLET FLOW LOW 00PBM31CF001	12		X1				X1				X				X1																		X1													12	
SODIUM HYPOCHLORITE GENERATOR B INLET FLOW LOW 00PBM32CF001	13				X1				X1				X				X1																								X1						13	
SODIUM HYPOCHLORITE GENERATOR A OUTLET TEMPERATURE HIGH 00PBM31CT001	15		X1				X1				X				X1																		X1													15	
SODIUM HYPOCHLORITE GENERATOR B OUTLET TEMPERATURE HIGH 00PBM32CT001	16				X1				X1				X				X1																X1													16	
TRANSFORMER RECTIFIER 00PBM31GT001 TRIP/FAULT FROM TR CONTROL PANEL	18		X1				X1				X				X1																		X1													18	
TRANSFORMER RECTIFIER 00PBM32GT001 TRIP/FAULT FROM TR CONTROL PANEL	19				X1				X1				X				X1																								X1						19	
	20																																														20	
DEGASSING TANK 00PBM40BB001 LEVEL TRANSMITTER LOW 00PBM40CL002 (Note 3)	21																	X				X		X				X																		21	
DEGASSING TANK 00PBM40BB001 LEVEL TRANSMITTER LOW LOW 00PBM40CL001 (Note 3)	22																	X				X		X				X																		22	
DEGASSING TANK 00PBM40BB001 LEVEL TRANSMITTER 00PBM40CL002 < 50% after 30 min timer expired (Note 4)	23		X				X				X				X																															23	
DEGASSING TANK 00PBM40BB001 LEVEL TRANSMITTER HIGH 00PBM40CL002 (Note 2)	24		X1				X1				X				X1																		X1													24	
DEGASSING TANK 00PBM40BB001 LEVEL TRANSMITTER HIGH HIGH 00PBM40CL001 (Note 2)	25		X				X				X				X																		X													25	
DEGASSING TANK 00PBM40BB002 LEVEL TRANSMITTER LOW 00PBM40CL004 (Note 3)	27																	X				X		X				X																		27	
DEGASSING TANK 00PBM40BB002 LEVEL TRANSMITTER LOW LOW 00PBM40CL003 (Note 3)	28																	X				X		X				X																		28	
DEGASSING TANK 00PBM40BB002 LEVEL TRANSMITTER 00PBM40CL004 < 50% after 30 min timer expired (Note 4)	29		X				X				X				X																															29	
DEGASSING TANK 00PBM40BB002 LEVEL TRANSMITTER HIGH 00PBM40CL004 (Note 2)	30		X1				X1				X				X1																								X1							30	
DEGASSING TANK 00PBM40BB002 LEVEL TRANSMITTER HIGH HIGH 00PBM40CL003 (Note 2)	31		X				X				X				X																								X							31	
	32																																															32	
DEGASSING TANK 00PBM40BB002 AIR BLOWER 00PBM47AN001 TRIP/FAULT FROM MCC	33																															X	X														33	
DEGASSING TANK 00PBM40BB002 AIR BLOWER 00PBM48AN001 TRIP/FAULT FROM MCC	34																													X				X													34	
DEGASSING TANK 00PBM40BB002 AIR BLOWER 00PBM47AN001 AND 00PBM48AN001 TRIP/FAULT FROM MCC	35		X		X		X		X	X		X		X		X		X		X		X		X		X		X		X						X		X							35	
DEGASSING TANK 00PBM40BB001 AIR BLOWER 00PBM49AN001 TRIP/FAULT FROM MCC	33																																														33	
DEGASSING TANK 00PBM40BB001 AIR BLOWER 00PBM50AN001 TRIP/FAULT FROM MCC	34																																														34	
DEGASSING TANK 00PBM40BB001 AIR BLOWER 00PBM49AN001 AND 00PBM50AN001 TRIP/FAULT FROM MCC	35		X		X		X		X	X		X		X		X		X		X		X		X		X		X		X		X													35	
	36																																															36	

EFFECT / CAUSE		SEAWATER BOOSTER PUMP				FLOW CONTROL VALVE				TRANSFORMER RECTIFIER				ON/OFF VALVE				HYPO DOSING PUMP												AIR BLOWER								ACID CLEANING PUMP									
		SEAWATER BOOSTER PUMP A	SEAWATER BOOSTER PUMP A	SEAWATER BOOSTER PUMP B	SEAWATER BOOSTER PUMP B	SODIUM HYPOCHLORITE GENERATOR A INLET FV	SODIUM HYPOCHLORITE GENERATOR A INLET FV	SODIUM HYPOCHLORITE GENERATOR B INLET FV	SODIUM HYPOCHLORITE GENERATOR B INLET FV	TRANSFORMER/RECTIFIER A	TRANSFORMER/RECTIFIER A	TRANSFORMER/RECTIFIER B	TRANSFORMER/RECTIFIER B	SODIUM HYPOCHLORITE GENERATOR A OUTLET X	SODIUM HYPOCHLORITE GENERATOR A OUTLET X	SODIUM HYPOCHLORITE GENERATOR B OUTLET X	SODIUM HYPOCHLORITE GENERATOR B OUTLET X	CONTINUOUS HYPO DOSING PUMP A	CONTINUOUS HYPO DOSING PUMP A	CONTINUOUS HYPO DOSING PUMP B	CONTINUOUS HYPO DOSING PUMP B	SHOCK HYPO DOSING PUMP A	SHOCK HYPO DOSING PUMP A	SHOCK HYPO DOSING PUMP B	SHOCK HYPO DOSING PUMP B	SHOCK HYPO DOSING PUMP C	SHOCK HYPO DOSING PUMP C	CONTINUOUS HYPO DOSING PUMP A to PTP	CONTINUOUS HYPO DOSING PUMP A to PTP	CONTINUOUS HYPO DOSING PUMP B to PTP	CONTINUOUS HYPO DOSING PUMP B to PTP	AIR BLOWER A (DEGASSING TANK A)	AIR BLOWER A (DEGASSING TANK A)	AIR BLOWER B (DEGASSING TANK A)	AIR BLOWER B (DEGASSING TANK A)	AIR BLOWER A (DEGASSING TANK B)	AIR BLOWER A (DEGASSING TANK B)	AIR BLOWER A (DEGASSING TANK B)	AIR BLOWER A (DEGASSING TANK B)	ACID CLEANING PUMP A	ACID CLEANING PUMP A	ACID CLEANING PUMP B	ACID CLEANING PUMP B				
	ACTION	START	STOP	START	STOP	OPEN	CLOSE	OPEN	CLOSE	START	STOP	START	STOP	OPEN	CLOSE	OPEN	CLOSE	START	STOP	START	STOP	START	STOP	START	STOP	START	STOP	START	STOP	START	STOP	START	STOP	START	STOP	START	STOP	START PERMISSIVE	STOP	START PERMISSIVE	STOP				REMARKS
	DEVICE	00PBM21AP001	00PBM21AP001	00PBM22AP001	00PBM22AP001	00PBM31AA601	00PBM31AA601	00PBM32AA601	00PBM32AA601	00PBM51G T001	00PBM51G T001	00PBM52G T001	00PBM52G T001	00PBM31AA602	00PBM31AA602	00PBM32AA602	00PBM32AA602	00PBM41AP001	00PBM41AP001	00PBM42AP001	00PBM42AP001	00PBM43AP001	00PBM43AP001	00PBM44AP001	00PBM44AP001	00PBM45AP001	00PBM45AP001	00PBM46AP001	00PBM46AP001	00PBM47AP001	00PBM47AP001	00PBM17AN001	00PBM17AN001	00PBM18AN001	00PBM18AN001	00PBM19AN001	00PBM19AN001	00PBM49AN001	00PBM50AN001	00PBM50AN001	00PBM52AP001	00PBM52AP001	00PBM53AP001	00PBM53AP001				
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	
DEGASSING TANK 00PBM40BB001 AIR FLOW LOW 00PBM49CF001 (Note 5)	37																																		X	X								37
DEGASSING TANK 00PBM40BB001 AIR FLOW LOW 00PBM49CF001 AFTER CHANGEOVER TO STANDBY AIR BLOWER 00PBM50AN	38		X				X				X				X																X		X									38
DEGASSING TANK 00PBM40BB002 AIR FLOW LOW 00PBM47CF001 (Note 5)	39																														X	X										39
DEGASSING TANK 00PBM40BB001 AIR FLOW LOW 00PBM49CF001 AFTER CHANGEOVER TO STANDBY AIR BLOWER 00PBM50AN	40		X				X				X				X																				X		X							40
	41																																											41
CONTINUOUS DOSING PUMP 00PBM41AP001 TRIP/FAULT FROM MCC	42																		X																									42
CONTINUOUS DOSING PUMP 00PBM42AP001 TRIP/FAULT FROM MCC	43																	X																									43
SHOCK DOSING PUMP 00PBM43AP001 TRIP/FAULT FROM MCC	44																						X		X																			44
SHOCK DOSING PUMP 00PBM44AP001 TRIP/FAULT FROM MCC	45																					X			X																			45
SHOCK DOSING PUMP 00PBM45AP001 TRIP/FAULT FROM MCC	46																					X		X																			46
CONTINUOUS DOSING PUMP to PTP 00PBM46AP001 TRIP/FAULT FROM MCC	47																													X													47
CONTINUOUS DOSING PUMP to PTP 00PBM47AP001 TRIP/FAULT FROM MCC	48																											X															48
	49																																											49
ACID MODE SELECTED FOR 00PBM31AG001 from HMI	50		X1				X1				X				X1																	X1												50
ACID MODE SELECTED FOR 00PBM32AG001 from HMI	51				X1				X1				X				X1																			X1								51
	52																																											52
ACID PUMP 00PBM52AP001 TRIP/FAULT FROM MCC	53																																						X	X					53
ACID TANK LOW LEVEL 00PBM50CL001	54																																						X		X				54
Emergency Shutdown from PLC Panel	5		X		X		X		X		X		X		X		X		X		X		X		X		X		X		X		X		X		X		X				5
HYDROGEN DETECTOR HIGH HIGH LEVEL	56		X		X		X		X		X		X		X		X		X		X		X		X		X		X		X		X		X		X		X				56
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	

X: Action with no time delay
X1: Action with 1 min time delay
X6: Duty shock dosing pump for CW Forebay run for 30 min and continues dosing pump for CW Forebay stops for 30 mins (24 hours 3 times, 7.5 hours interval)

NOTES:

1. This cause and effect chart is written assuming the following are the duty equipment
   -00PBM21AP001
   - 00PBM31AG001
   - 00PBM41AP001
   -00PBM43AP001 and 00PBM44AP001
   - 00PBM46AP001
   - 00PBM47AN001 and 00PBM49AN001
   - 00PBM52AP001

NOTES:-

1. When Hypochlorite Storage / Degassing Tank liquid level increases to normal liquid level, sodium hypochlorite restart automatically by running duty continuous duty pump.
2. Auto resume of duty continuous dosing pump when liquid level increases above normal liquid level transformer rectifier automatically stop at High level and After activation of High High level Operator need to reset the system before start-up.
3. Auto resume of hypochlorite generation when liquid level drops to below liquid level Continuous Dosing pump is stop at Low Level and after activation of Low Low Level Operator need to reset the system before start-up.
4. 30 min timer activated If tank liquid level did not reach 50% within 30 mins & dosing pump is not running, relevant sodium hypochlorite generator and dosing train is stops. Operator need to reset the system before start-up.
5. Duty blower will stop after 30 seconds time delay to ensure continuity of air flow from both blowers to dilute the hydrogen before standby blower rams at full speed to produce sufficient airflow.
6. Any signal to be incorporated on later stage shall be taken care at site by M/s Denora.

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

REV	DATE	ALTERED: / CHECKED:	REV	DATE	ALTERED / CHECKED

APPROVED

STATUS : CONTRACT

JOB NO.: 412

BHARAT HEAVY ELECTRICALS LTD
PROJECT ENGINEERING MANAGEMENT.

This approval status shall be interpreted as laid down in the contract and it shall not relieve the contractor from the contractual obligation.

APPROVAL CATEGORY AWARDED = 1

CAT I - Approved
CAT II - Approved With Comments as Noted
CAT III - Not Approved
CAT IV - Reference Drawing

DEPARTMENT	MECHANICAL AUXILIARY
NAME: FALGUNI SAHA	

2018.11.13 11:25:56 +05'30'

2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

BHARAT HEAVY ELECTRICALS LIMITED

PROJECTS ENGINEERING MANAGEMENT, NOIDA.

BHEL DOC. NO. : PE-V11-412-174-A1131

SUB CONTRACTOR :DE NORA INDIA LIMITED
KUNDAIM - GOA

DE NORA

ASSOCIATE PARTNER : DE NORA WATER TECHNOLOGIES, SINGAPORE BRANCH

LOA NO: PW/PE/PG/EN1/P–24/17 DATED: 22 APR 2017

DEPT.	CODE		SCALE	WEIGHT(KG)	REF DRG.	ITEM
--	A		–	–	–	–

DATASHEET & GAD FOR EOT CRANE

	NAME	SIGN	DATE
PREP	SN		
CHKD	PG		
APPD	RF		

DEPT.							CARD CODE
SIGN			N.A.				–
DATE							

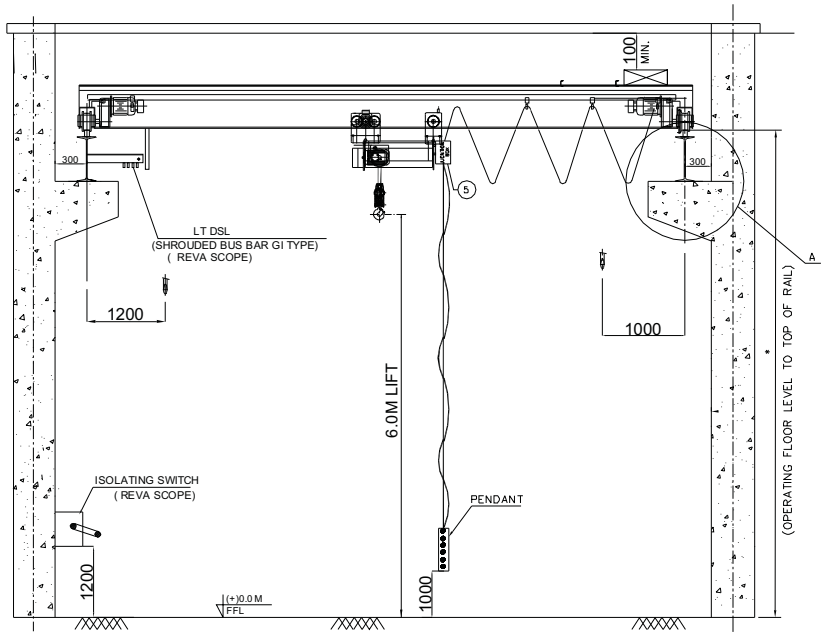
BHEL DOC. NO.
PE - V11 - 412 - 174 - A131

REV R0

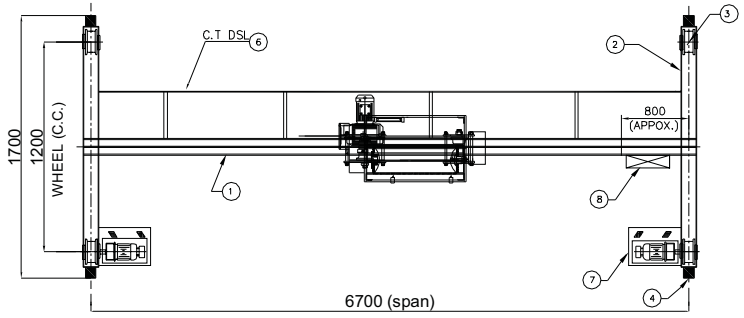
NO. OF SHEETS 3 EXCLUDING COVER PAGE

PROJECT :	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS	ELECTRO CHLORINATION SYSTEM	
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED	TECHNICAL DATASHEET FOR EOT CRANE	
BIDDER / VENDOR	DE NORA INDIA LIMITED	BHEL DOC. No. :	Rev-R0
Sr. No.	**Parameter**	**Reva Details**	
1	Type of Crane	S/G Eot Crane cap. 3 T	
2	Crane No.	11601-1	
3	Nos Reqd.	1	
4	Operation	Pendent Operated	
5	Radio Remote Control	NO	
6	Control	110 V Through Squirrel cage Motor	
7	Indoor / Outdoor	Indoor	
8	Location	ELECTRO CHLORINATION BUILDING	
9	Class of Duty	CLASS S4	
10	**Lifting Capacity MT**		
	MH	3 T	
11	Span in MM	6700	
12	**Height of Lift**		
	Above GL (M)	6	
	Below GL (M)	0	
13	**Operating Speeds (MPM)**		
	MH	0.3 – 3 MPM WITH VVF DRIVE	
	CT	1.6 – 16 MPM WITH VVF DRIVE	
	LT	2.0 - 20 MPM WITH VVF DRIVE	
14	Power Supply	415 V	
15	Control Voltage	110 V	
16	**MH Motor**		
	Type	Squirrel cage Motor	
	KW	2.2	
	Poles	4	
	No. of Starts / hour	150 / Hour	
	CDF	40 %	
	Qty.	1	
	Insulation Class	F	
	Degree of Protection	45 Deg.	
17	**LT Motor**		
	Type	Squirrel cage Motor	
	KW	0.55	
	Poles	4	
	No. of Starts / hour	150 / Hour	
	CDF	40 %	
	Qty.	2	
	Insulation Class	F	
	Degree of Protection	45 Deg.	
18	**CT Motor**		
	Type	Squirrel cage Motor	
	KW	0.55	
	Poles	4	
	No. of Starts / hour	150 / Hour	
	CDF	40 %	
	Qty.	1	
	Insulation Class	F	
	Degree of Protection	45 Deg.	
19	**Limit Switches**		
	Hoist	Rotary / Gravity Type	
	CT	Two Way Lever Type	
	LT	Two Way Lever Type	
20	**Brake Type**		
	MH	DC DISC TYPE	
	CT	DC DISC TYPE	
	LT	DC DISC TYPE	

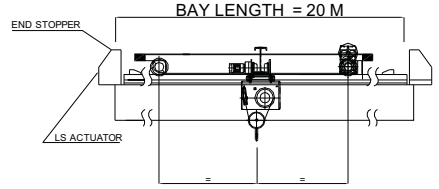
21	**Gear Boxes**		
	Type	Helical Hardened Gear Box	
	Make	Reva	
	Material of Pinion	Low carbon alloy steel	
	Hardness of Pinion	55-60 HRC	
	Material of Gear	Low carbon alloy steel	
	Hardness of Gear	55-60 HRC	
22	**MH Wire Rope**		
	Type	Steel core wire rope	
	Construction	6 x 36	
	Factor of Safety	6	
	IS Cod	2266	
	rope Dia	9 mm	
	Falls	4	
23	**Rope Drum**		
	Type	seamless steel pipe	
	Material of Construction	seamless steel pipe ASTMA Grade A OR B	
24	**Wheels**		
	Type	double flange wheel	
	Material of Wheels	EN8/EN9	
	Hardness of Wheels	300-350 BHN	
	Size (Dia. In MM) - LT	160mm	
	Qty.	4 NOS	
	Size (Dia. In MM) - CT	160mm	
	Qty.	4 NOS	
25	**LT Rail**		
	Size	50X50 Sq.Bar	
	Scope of Supply	IN REVA SCOPE	
26	**LT DSL**		
	Type	Shrouded Bus Bar GI Conductor type	
	Scope of Supply	IN REVA SCOPE	
27	Bay Length	20 Meter	
28	Ambient Temprature (in deg C)	45 Deg.	
29	Approx. Wheel Load (Ton) (Max. Static)	1.74 TON	
30	**Type of Hook**		
	MH	PLAIN SHANK TRAPEZOIDAL SECTION	
31	Provision of Safety Latch	Yes	
32	Couplings	GEARED COUPLING	
33	Bridge Construction	I - BEAM	
34	Buffers	SPRING BUFFER IN LT AND RUBBER WIRE IN CT	
35	Cables	copper type	
36	Radiography	Yes	
37	Hooks	Yes	
38	Lubrication	Yes	
39	Painting	Yes	
40	Control Panels	Yes	



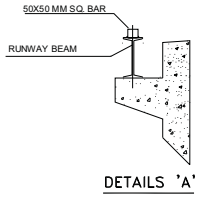
ELEVATION



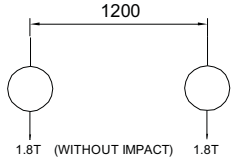
PLAN



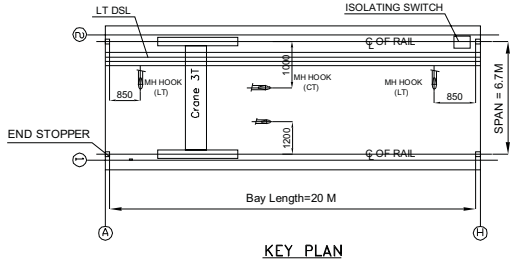
SIDE VIEW



DETAILS 'A'



LT WHEEL LOAD DIAGRAM



KEY PLAN

FOR APPROVAL

BILL OF MATERIAL

	LOCATION	M.H	C.T	L.T
MOTOR	KW/ QTY	2.2/ 01	0.55 / 01	0.55 / 02
	MAKE	~~LMP/MARATHON/ABB~~ CGL/BBL		
	TYPE	TEFC,CLASS 'F' INSULATION 150 ST.HOUR,SQ.CASE S4 CRANE DUTY MOTOR,40% CDF,4P FOR MH& 4P FOR CT/LT, SUITABLE FOR AMBIENT 50°C, 415V±10% & 50Hz±5% VARIATIONS AS PER IS:325		
LIMIT SWITCH	LOCATION	MH	C.T	L.T
	TYPE/QTY.	SNAP ACTION/02	TWO WAY LEVER/01+01	
	MAKE	BCH/JAIBALAJI /SOC/KAKU/SCHNEIDER		
BRAKE	LOCATION	M.H	C.T	L.T
	SIZE/RATING	12/3.2 KgM	06/0.41KgM	06/0.41KgM
	TYPE	EM DC DISC TYPE		
	MAKE	EMCO/PETHE		
GEAR BOX (HOISTING)	MAKE	REVA		
	TYPE	HELICAL		
	LUBRICATION	OIL SPLASH		
	REDUCTION	83:1		
	GEAR & PINION MATERIAL	20MnCr5 LOW CARBON		
	GEAR & PINION HARDNESS	55 HRC (MIN.)		
	MAKE	SKF/NBC/NORMA/TATA/FAG/NRB		
	BEARING TYPE	ANTI-FRICTION DEEP GROOVE BALL BEARING/ S.A.S ROLLER BEARING		
GEAR BOX (C.T & L.T)	LOCATION	C.T	L.T	
	MAKE	REVA		
	TYPE	HELICAL		
	LUBRICATION	GREASE	GREASE	
	REDUCTION	15:1	15:1	
	GEAR & PINION MATERIAL	MEDIUM ALLOY STEEL		
	GEAR & PINION HARDNESS	240-280 BHN		
	BEARING MAKE	SKF/NBC/TATA/NORMA/NRB/FAG		
	BEARING TYPE	ANTI-FRICTION DEEP GROOVE BALL BEARING/ TAPER ROLLER BEARING		
HOOK	MAKE	SMRITI FORGING/REVA/KARACHIWALA/SARVODYA FORGING		
	TYPE	PLAIN SHANK TRAPEZOIDAL SECTION CL.-2 OR MORE AS PER IS:1875 & IS:15560		
	BEARING	THRUST BALL BEARING		
	MAKE	SKF/NBC/TATA/NORMA/NRB/FAG		
WIRE ROPE DRUM	MATERIAL	SEAMLESS PIPE, ASTM A10653, GR-A/B		
WIRE ROPE	MAKE	USHA MARTIN		
	CONSTRUCTION/CORE	6X36/STEEL CORE		
	WIRE ROPE Ø/FALL	9/4		
	TENSILE STRENGTH	180Kg/mm2(1770 N/mm2)		
	MIN. BREAKING LOAD	5.20 T AS PER IS:(2266)		
WHEELS	LOCATION	C.T	L.T	
	DIAMETER	100mm	160mm	
	QTY.	05	04	
	HARDNESS	170-190 BHN	300-350 BHN	
	MATERIAL	EN-8/EN-9/C55Mn75		
	BEARING MAKE	SKF/NBC/NORMA/TATA/NRB/FAG		
	BEARING TYPE	ANTI-FRICTION DEEP GROOVE BALL BEARING		
SHEAVE	MATERIAL	CI. FG200 AS PER IS 210		
	GROOVE DIA/OD	170/200 MM		
	BEARING MAKE	SKF/NBC/TATA/NORMA/NRB/FAG		
	BEARING TYPE	ANTI-FRICTION DEEP GROOVE BALL BEARING		

NOTE:-

1. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE SPECIFIED.
2. DIMENSIONS ARE SUBJECTED TO ±50mm VARIATION (EXCEPT SPAN & DIAGONAL)
3. PAINTING :
   A) 2 COATS OF RED OXIDE ZINC CHROMATE- DFT / COAT -35 MICRONS
   B) 2 COATS OF EPOXY BASED- DFT / COAT -25 MICRONS
   C) SHADE GOLDEN YELLOW
4. * MARKED DIMENSION SHOULD BE FURNISHED BY CLIENT.
5. LOAD TEST AS PER IS:3177-1999.
6. OPERATION THROUGH PENDANT .

S.NO.	ITEM DESCRIPTIONS	QTY	MATERIAL
08	CONTROL PANEL	01	STD.
07	LT MAINTENANCE PLATFORM	02	IS: 2062
06	CT DSL C/T TRACK	01	STD.
05	JUNCTION BOX	01	STD.
04	BUFFER	04	RUBBER
03	L.T. WHEEL	04	EN8/EN9
02	END CARRIAGE	02	IS: 2062
01	MAIN GIRDER	01	IS: 2062

LOCATION	INDOOR
EQUIP. NO.	11601.1
S.W.L	3T
QTY	1 NO.
CLASS OF DUTY/ DESIGN STANDARD	CI - II (M5) IS : 3938,3177 & 807
SPAN	6.7 M
LIFT	6.0 M
TRAVEL LENGTH	20 M
HOISTING SPEED	3.0 MPM
C.T. SPEED	16 MPM
L.T. SPEED	20 MPM
CRANE WEIGHT	1.8 T (APPX.)
HOIST WEIGHT	0.4T (APPX)
DRUM Ø	Ø220/600

Reva Industries Ltd.
Faridabad -121004

R NO	REVISION	DATE	SIGN	SCALE: NTS.	DATE	05.11.2018
					DRAWN	MANGAL
					CHKD.	ARVIND
					APPD.	ROHIT

TITLE: –

G.A. DRG OF 3T SINGLE GIRDER EOT CRANE

CLIENT:

2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS

PROJECTION:-

DRG NO. 11601.1/GA/R0

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

REV	DATE	ALTERED: / CHECKED:	REV	DATE	ALTERED / CHECKED

APPROVED WITH COMMENTS

STATUS : CONTRACT

JOB NO.: 412

BHARAT HEAVY ELECTRICALS LTD
PROJECT ENGINEERING MANAGEMENT.
This approval status shall be interpreted as laid down in the contract and it shall not relieve the contractor from the contractual obligation.
APPROVAL CATEGORY AWARDED = II
CAT I - Approved
CAT II - Approved With Comments as Noted
CAT III - Not Approved
CAT IV - Reference Drawing
DEPARTMENT: MECHANICAL AUXILIARY
NAME: FALGUNI SAHA

2019.03.22 09:11:19 +05'30'

2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

BHARAT HEAVY ELECTRICALS LIMITED
PROJECTS ENGINEERING MANAGEMENT, NOIDA.

BHEL DOC. NO. : PE-V11-412-174-

SUB CONTRACTOR :DE NORA INDIA LIMITED
KUNDAIM - GOA

DE NORA

ASSOCIATE PARTNER : DE NORA WATER TECHNOLOGIES, SINGAPORE BRANCH

LOA NO: PW/PE/PG/EN1/P-24/17 DATED: 22 APR 2017

DEPT.	CODE		SCALE	WEIGHT(KG)	REF DRG.	ITEM
--	A		-	-	-	-

DATASHEET FOR INSTRUMENT AND ANALYSER (chlorine)

	NAME	SIGN	DATE
PREP	PG		
CHKD	DD		
APPD	RF		

DEPT.							CARD CODE	BHEL DOC. NO.	REV
SIGN			N.A.				-	PE-V11-412-174-	0
DATE								NO. OF SHEETS 151 EXCLUDING COVER PAGE	

TAMILNADU GENERATION AND DISTRIBUTION CORPORATION LTD

From	To
Er. N.MALA, B.E, Superintending Engineer/Electrical, Thermal Hydro Projects /TANGEDCO, 5th floor, Western wing, 144, Anna salai, Chennai-600002 Tel: 044-28521591, Mobile:+919445857544, Email: sethhyp@tnebnet.org	Bharat Heavy Electricals Limited, POWER PROJECT ENGINEERING INSTITUTE HRD & ESI COMPLEX NOIDA - 201301(U.P)

Lr No.SE/E/TH(P)/EE2/AEE/F. PEM /D. 255 / 19 dt. 20.03.2019

Project Title	2x660 MW Supercritical Ennore SEZ TPP
TANGEDCO Reference No.	LOA.Lr No. CE/P/SE/M/P/EE-10/E/P/F.2X660 MW Ennore SEZ STPP/D 60/14, Dt.27.09.2014
BHEL Reference No:	1.Desein Letter, D- 4027/TANGEDCO/5739 dt 16.03.2019 2.BHEL Letter.dt.05.03.2019.
Subject	DATASHEET FOR INSTRUMENT AND ANALYSER (chlorine)

Sir,

Sub: TANGEDCO – Comments/Approval on the drawings/documents submitted by M/s BHEL-Reg.

The comments/approval on the drawings/documents submitted by M/s BHEL on the above subject vide M/s. BHEL transmittal under reference is furnished below.

Sl No	DRG/DOC No	DESCRIPTION	Rev No.	Status	Remarks
1	PE-V11-412-174-A115	DATASHEET FOR INSTRUMENT AND ANALYSER (chlorine)	00	03	M/s BHEL is requested to attend the comments given in the annexure and resubmit the revised document for approval.

Status : Category **1**- Approved. Category: **2** – Approved with comments, Resubmit for approval under Category **1**. Category **3** – Not approved (See attachment Memo) Resubmit for approval. Category **4** – Information furnished is noted.

Yours faithfully,

Sd- 20.03.2019
Superintending Engineer/Electrical
Thermal Hydro Project/TANGEDCO

Copy to Shri E.V. Anand / DESEIN Pvt. Ltd., Consulting Engineers, Desein House, Greater Kailash-II NewDelhi-110048.
Copy Submitted to The Chief Engineer/Civil/Projects/Ennore SEZ TPP,Athipattu, Chennai 120.

ANNEXURE

S.No.	Comments	BHEL Reply
1.	Title of the document shall also include the package name.	
2.	Index Sheet shall be included.	
3.	KKS tag no and quantities for each instrument shall be provided as same indicated in the approved P&ID.	
4.	Each KKS tag no. shall have prefix 10 or 20 or 90 as per requirements in line with specification depending on allocation for respective unit or for common system.	
5.	Origin of country shall be indicated for complete unit (Sensor & Transmitter) in line with approved vendor list.	
6.	Vendor name shall be as per approved vendor list only. BHEL is advised to also enclosed the copy of approved vendor list accordingly.	
7.	All field instruments shall be weatherproof, drip tight, dust tight and splash proof suitable for use under outdoor ambient conditions prevalent in the subject plant. All field-mounted instruments shall be mounted in suitable locations where maximum accessibility for maintenance is achieved.	
8.	The enclosures of all electronic instruments shall conform to IP-65 unless otherwise specified (Explosion proof for NEC article 500, class 1, Division 1 area & flame proof) and an anti-corrosive paint shall be applied to the field mounted enclosures / instruments.	
9.	All the field instruments shall also be provided with SS tag nameplate and double compression type Nickel-plated brass cable gland.	
10.	Snubbers/Pulsation dampners shall be used, where the process media is unstable for measurement such as the discharge of a pump as per technical specification Vol. V, cl.no. 3.03.01, 3.03.02, 3.03.03 and Technical specification/Contract Vol. VII, Installation drawings.	
11.	BHEL to also note as per TANGEDCO's Letter no: SE/E/T&H(P)/EE-8 /F.2x660MW Ennore SEZ STPP/D 95 / 15 , dated 01.07.2015 for Sea/Saline water services, following shall be applicable:-	
i.	For Low Pressure application, MOC of impulse tubing & impulse pipe shall be CPVC (3/8") Sch 80 or better, Industrial grade up to manifold. MOC of impulse tubing, fittings (from manifold to instrument) and manifold shall be super duplex SS.	
ii.	As per EDN DOCUMENT, ASTM D1784 CPVC PIPE(INDUSTRIAL GRADE) - 1/2"NB SCH 80 SHALL be included.	
iii.	For High pressure application, MOC of Impulse tubing, impulse pipes, fittings and manifold shall be super duplex SS (1/2"). BHEL to follow the above requirements in totality.	
12.	BHEL to ensure the compliance of specification, Vol. V, Chapter 3, cl. No. 3.03.01 for Pressure transmitters and Diff. Pressure Transmitters.	
i.	BHEL to ensure that complete Electrical Signals and Interfacing signals shall be included in the I/O List in line with final approved sub-Vendor drgs/documents.	
ii.	BOM shall be updated as per final approved P&IDs.	
iii.	Type of sensor shall be specified inline with technical specifications vol. V, Ch-3, cl. No. 3.03.01.	
iv.	Origin of country shall be indicated for complete unit (Sensor & Transmitter) in line with approved vendor list.	
v.	Stability of +/- 0.15% of URL for 5 years.	
vi.	Local indication with LCD indicator (5 digit) with scale of Engg. Units	
vii.	Span and Zero - Locally adjustable, non-interacting	
viii.	Zero suppression / elevation facility.	
ix.	Electrical connection Suitable for Plug in type connection (Both side of transmitter), unused entry with blind plug.	
x.	Manifold should not be mounted on the transmitter, Manifold shall be non-integral and standalone type.	
xi.	Turn down ratio shall be 1 :100.	
xii.	Accuracy shall be +/- 0.04%.	
xiii.	In line with specification, Vol. V, Chapter 3, Counter and mating flange (SS316 material), fastener, gaskets, Nuts, bolts etc. shall also be included, wherever required.	
xiv.	Material for enclosures and wetted part shall be suitable for sea water and saline conditions at site and process medium.	
13.	Please confirm compliance the following as per specification, Vol. V, Chapter 3, cl. No. 3.03.12 for USLT:- Complete details shall be included in the data sheets accordingly.	
i.	Operating frequency range shall be 10 KHz to 50 KHz (typical).	
ii.	Head mounted alpha-numeric back lit LCD/LED display is provided.	
iii.	Calibration and configuration is accessible from front of panel & HART calibrator.	
iv.	Status for power, Hi / Lo / V. Hi / V. Lo- level indication, fault etc. are available.	
v.	Diagnostic is available on line.	
vi.	2SPDT Potential free changeover contacts @ 8A 230V AC are provided.	
vii.	Accuracy and repeatability are +/- 0.25% of span or better	
viii.	Resolution is +/- 0.1% of span	
ix.	Temperature compensation is provided with the sensor.	
x.	Enclosure is provided with minimum IP-67 protection class and Epoxy painted die cast Aluminum or SS316L housing.	
xi.	Operating frequency range shall be 10 KHz to 50 KHz (typical).	
xii.	BOM shall be updated as per final approved P&IDs.	

S.No.	Comments	BHEL Reply
xiii.	In line with specification, Vol. V, Chapter 3, Counter and mating flange (SS316 material), fastener, gaskets, Nuts, bolts etc. shall also be included, wherever required.	
xiv.	Signal and Electrical connection shall be screwed connection with double compression type Nickel-plated brass/SS316 cable glands. Please check & confirm the requirements.	
xv.	All the outdoor field instruments such as analysers/transmitters/meters etc. shall be provided with suitable Free standing cabinet(s)/panel/rack so that the equipments are protected against rain/ sunlight etc. Please confirm & comply.	
xvi.	SS Tag Plate with detail description & Tag. No. shall be provided.	
14.	Please confirm compliance the following as per specification, Vol. V, Chapter 3, cl. No. 3.03.14 for Radar type LT:- Complete details shall be included in the data sheets accordingly.	
i.	Flange rating and material shall be ANSI 300 lb SS316L material respectively.	
ii.	LCD digital local display shall be provided.	
iii.	Diagnostic is available on line.	
iv.	Electromagnetic compatibility shall be as per EN 61326.	
v.	Resolution is +/- 1 mm.	
vi.	Enclosure is provided with minimum IP-67 protection class and Epoxy painted die cast Aluminum or SS316L housing.	
vii.	In line with specification, Vol. V, Chapter 3, Counter and mating flange (SS316 material), fastener, gaskets, Nuts, bolts etc. shall also be included, wherever required.	
viii.	Signal and Electrical connection shall be screwed connection with double compression type Nickel-plated brass/SS316 cable glands. Please check & confirm the requirements.	
ix.	All the outdoor field instruments such as analysers/transmitters/meters etc. shall be provided with suitable Free standing cabinet(s)/panel/rack so that the equipments are protected against rain/ sunlight etc. Please confirm & comply.	
x.	SS Tag Plate with detail description & Tag. No. shall be provided.	
15.	BHEL to ensure the compliance of specification, Vol. V, Chapter 3, cl. No. 3.03.03 for Pressure Gauges and Diff Pressure Gauges .	
i.	Case material shall be SS 316/ Die-cast aluminum with stoved enamel black finish. Epoxy coating shall be provided for corrosive atmosphere.	
ii.	Please include the type of sensors for pressure Gauges as per specification depending upon pressure ranges.	
iii.	Over range protection shall be 150 percent (%) of full scale inline with technical specifications vol. V, Ch-3, cl. No. 3.03.03.	
iv.	Material of movement shall be SS316 instead of SS304 inline with technical specifications vol. V, Ch-3, cl. No. 3.03.03.	
v.	Scale detail shall be added like 270 degree dial rotation/deflection. Graduations in black lines on white dial provided with glass cover. Smallest scale division shall be one (1) percent of full scale value or smaller .Pointer stop for all gauges	
vi.	External zero adjustment shall be provided inline with technical specifications vol. V, Ch-3, cl. No. 3.03.03.	
vii.	As per technical specification, Vol. V, Ch-3, cl. No. 3.03.03, BHEL to provide Rubber blow out disc with open front construction for Ranges 5 to 20 Kg/cm2.	
viii.	As per technical specification, Vol. V, Ch-3, cl. No. 3.03.03, BHEL to provide Neoprene safety diaphragm at the back with solid front construction for Ranges above 20 Kg/cm2.	
ix.	BOM shall be updated as per final approved P&IDs.	
x.	Material for enclosures and wetted part shall be suitable for sea water and saline conditions at site and process medium.	
16.	Please confirm compliance the specification, Vol. V, Chapter 5, cl. No. 5.20.00 for residual chlorine analyser. Emerson make is approved make, Please confirm.	
i.	Power supply to analysers shall be indicated from UPS only.	
ii.	All major equipment/systems shall be served from UPS through redundant two 100% capacity feeders (from 2x100% ACDB) with a automatic change over at load point to ensure un-interrupted supply even on loss of one feeder as described elsewhere in the specifications, Vol. V, chapter 2. Power supply to analysers shall be designed accordingly.	
iii.	Each and every analyser shall be provided with HART protocol. In case same is not available, same shall be provided with alternative protocol like Modbus/profibus etc.	
iv.	All analysers shall be supplied with chemicals/regents required for 12 months operation. Bidder shall also provide start up kits, buffer solution for pH and conductivity analyzer. The analyser supplier shall submit the preparation procedure / formula of the reagent to be used in analyser solution.	
v.	In line with specification, Vol. V, Chapter 3, Counter and mating flange (SS316 material), fastener, gaskets, Nuts, bolts etc. shall also be included, wherever required.	
vi.	Signal and Electrical connection shall be screwed connection with double compression type Nickel-plated brass/SS316 cable glands. Please check & confirm the requirements.	
vii.	All the outdoor field instruments such as analysers/transmitters/meters etc. shall be provided with suitable Free standing cabinet(s)/panel/rack so that the equipments are protected against rain/ sunlight etc. Please confirm & comply.	
viii.	SS Tag Plate with detail description & Tag. No. shall be provided.	
ix.	Material of seamless tubes shall be corrected as Super duplex SS.	
x.	Double compression type fittings shall be provided.	
xi.	Gold Cathode/Silver Anode electrode shall be provided.	
xii.	Auto built in temperature compensation with PT 100 sensor shall be provided.	
xiii.	Resolution and diagnostic features shall be provided.	
17.	Please confirm compliance the following as per specification, Vol. V, Chapter 3, cl. No. 3.03.05 for RTD:- Complete details shall be included in the data sheets accordingly.	
i.	4 wire duplex RTD shall be provided.	
ii.	Threaded union (SS316) 1/2" NPT (F) with two nipples of SS 316 having 1/2"NPT(M) threads at both ends shall be provided instead of SS304 material.	
iii.	Response time shall be indicated with thermowell/protective sheath as 30 seconds and 6-10 seconds without thermowell.	

S.No.	Comments	BHEL Reply
iv.	Electrical connection shall be Gold plated Plug in type, Double entry, one unused entry with blind plug.	
v.	In line with specification, Vol. V, Chapter 3, Counter and mating flange (SS316 material), fastener, gaskets, Nuts, bolts etc. shall also be included, wherever required.	
vi.	SS Tag Plate with detail description & Tag. No. shall be provided.	
vii.	Insulation resistance shall be More than 1000 M Ohms at Ambient temperature	
viii.	Magnesium Oxide shall be provided with high purity of 99.4% minimum	
ix.	BHEL to provide detailed calculation for thermowell as per ASME – PTC-19.3 (latest edition). “All Thermowells in high velocity steam service shall be checked for Strouhal’s frequency limit to arrive at a safer size and design of Thermowells”.	
x.	Double cable entry shall be provided, unused cable entry shall be provided with blind metal plug. All the field instruments shall also be provided with SS tag nameplate. Counter and mating flange (SS316 material), fastener, gaskets, Nuts, bolts etc. shall also be included wherever required with the field instruments.	
xi.	BOM shall be updated as per final approved P&IDs.	
xii.	Material for enclosures and wetted part shall be suitable for sea water and saline conditions at site and process medium.	
18.	BHEL to provide Temperature transmitters, wherever Temperature measurement is required for monitoring purpose only as per technical specification, Vol. V. cl. no. 3.02.00 (xxi), cl. no. 9.04.00 (vii-2-iv and vii-2-v) and Post Bid resolution Annex-7 (27). RTD or Thermocouple used for any control/interlock/protection shall be directly wired to control system. Please review and revise the list accordingly.	
i.	Please confirm compliance the following as per specification, Vol. V, Chapter 3, cl. No. 3.03.04 :- Complete details shall be included in the data sheets accordingly.	
ii.	SS Tag Plate with detail description & Tag. No. shall be provided.	
iii.	BOM shall be updated as per final approved P&IDs.	
iv.	Dual input TT shall be provided.	
v.	Temp. Transmitter shall be extremely stable against Ambient temp variation, The accuracy figure shall be inclusive of effect due to ambient temperature variation.	
vi.	Accuracy of +/- 0.10%.	
vii.	Local indication with LCD indicator (5 digit) with scale of Engg. Units	
viii.	Span and Zero - Locally adjustable, non-interacting	
ix.	Calibration as per NIST monograph 125 for T/C & European Curve Alpha = 0.00385 for RTD .	
x.	Electrical connection Suitable for Plug in type connection (Both side of transmitter), unused entry with blind plug.	
xi.	Auto calibration is provided.	
xii.	Burn out protection upscale is provided.	
xiii.	Input - output isolation is provided.	
xiv.	Circuit ungrounded is provided.	

Sd- 20.03.2019

Superintending Engineer / THP

PROJECT :	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS			ELECTRO CHLORINATION SYSTEM			
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED			TECHNICAL DATASHEET FOR PRESSURE TRANSMITTER			
BIDDER / VENDOR	DE NORA INDIA LIMITED			BHEL DOC. No. : PE-V11-412-174-A115			Rev
GENERAL	1	Tag No.			90PBM21CP003, 90PBM21CP004, 90PBM21CP005		
	2	Quantity			3		
	3	Service			PRESSURE AT DISCHARGE OF STRAINER		
	4	Instrument Type			COPLANAR PRESSURE TRANSMITTER		
PROCESS CONDITIONS	5	Duty			CONTINUOUS		
	6	Fluid			SEAWATER		
	7	Specific Gravity			1.020		
	8	Design Temperature		Deg. C	50		
	9	Design Pressure		Kg/Cm2	5		
	10	Operating Flow		m3/Hr	150 - 175		
	11	Operating Pressure		Kg/Cm2	1 ~ 2		
	12	Operating Temperature		Deg. C	25 ~ 32		
	13	Humidity		%	5 ~ 100		
TRANSMITTER	14	Output signal type		mA	4 - 20 mA		
	15	Enclosure type number			IP 66		
	16	Elect. conn size Type			M20 X 1.5		
	17	Digital communication			HART Protocal		
	18	Signal power source			24VDc 2 Wire		
	19	Enclosure material			STAINLESS STEEL		
	20	Desplay type			LCD display		
	21	Instrument Range			–393 to 1000 inH2O (–0,97 to 2,48 bar)		
SEALS	22	Seal type			Isolating Diaphragm		
	23	Process conn size			1/2 NPT female		
	24	Process conn type			Threaded		
	25	Diaphragm / Wetted Parts material			Alloy - 400 (Monel)		
	26	Mounting type			2 " Pipe Mount		
	27	Mounting Bracket			Stainless steel		
	28	Fill fluid material			Silicone Oil		
	29	Overall Acuracy			± 0.04% Of Span		
	30	Stability			±0.2% of URL for Ten years		
MISCELLANEOUS	31	Make			EMERSON PROCESS MANAGEMENT		
	32	Model Number			3051CG3A44A1KM5B4L4D4Q4		
INSTRUMENT INDEX	Measurment/ Test		Input Min Range	Input Max range	Output Min Range	Output Max range	
	Pressure Output signal		4 mA	20 mA	0 Kg/Cm2	2 Kg/Cm2	
ACCESSORIES	Local SS Tag Plate						
	Coplanar flange bracket, all SST, 2-in. pipe and panel						

PROJECT :	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS			ELECTRO CHLORINATION SYSTEM			
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED			TECHNICAL DATASHEET FOR PRESSURE TRANSMITTER			
BIDDER / VENDOR	DE NORA INDIA LIMITED			BHEL DOC. No. : PE-V11-412-174-A115			Rev
GENERAL	1	Tag No.			90PBM23CP001, 90PBM23CP002		
	2	Quantity			2		
	3	Service			PRESSURE AT DISCHARGE OF SEAWATER BOOSTER PUMP		
	4	Instrument Type			COPLANAR PRESSURE TRANSMITTER		
PROCESS CONDITIONS	5	Duty			CONTINUOUS		
	6	Fluid			SEAWATER		
	7	Specific Gravity			1.020		
	8	Design Temperature		Deg. C	50		
	9	Design Pressure		Kg/Cm2	5		
	10	Operating Flow		m3/Hr	140 - 150		
	11	Operating Pressure		Kg/Cm2	2 ~ 2.5		
	12	Operating Temperature		Deg. C	25 ~ 32		
	13	Humidity		%	5 ~ 100		
TRANSMITTER	14	Output signal type		mA	4 - 20 mA		
	15	Enclosure type number			IP 66		
	16	Elect. conn size Type			M20 X 1.5		
	17	Digital communication			HART Protocal		
	18	Signal power source			24VDc 2 Wire		
	19	Enclosure material			STAINLESS STEEL		
	20	Desplay type			LCD display		
	21	Instrument Range			–14.2 to 300 psi (–0,97 to 20,68 bar)		
SEALS	22	Seal type			Isolating Diaphragm		
	23	Process conn size			1/2 NPT female		
	24	Process conn type			Threaded		
	25	Diaphragm / Wetted Parts material			Alloy - 400 (Monel)		
	26	Mounting type			2 " Pipe Mount		
	27	Mounting Bracket			Stainless steel		
	28	Fill fluid material			Silicone Oil		
	29	Overall Acuracy			± 0.04% Of Span		
	30	Stability			±0.2% of URL for Ten years		
MISCELLANEOUS	31	Make			EMERSON PROCESS MANAGEMENT		
	32	Model Number			3051CG4A44A1KM5B4L4D4Q4		

INSTRUMENT INDEX	Measurment/ Test	Input Min Range	Input Max range	Output Min Range	Output Max range	
	Pressure Output signal	4 mA	20 mA	0 Kg/Cm2	5 Kg/Cm2	

ACCESSORIES	
	Local SS Tag Plate
	Coplanar flange bracket, all SST, 2-in. pipe and panel

PROJECT :	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS		ELECTRO CHLORINATION SYSTEM		
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED		TECHNICAL DATASHEET FOR PRESSURE TRANSMITTER		
BIDDER / VENDOR	DE NORA INDIA LIMITED		BHEL DOC. No. : PE-V11-412-174-A115		Rev
GENERAL	1	Tag No.		90PBM41CP001, 90PBM42CP001	
	2	Quantity		2	
	3	Service		DISCHARGE OF CONTINOUS DOSING PUMP	
	4	Instrument Type		COPLANAR PRESSURE TRANSMITTER	
PROCESS CONDITIONS	5	Duty		CONTINUOUS	
	6	Fluid		SEAWATER + SODIUM HYPOCHLORITE	
	7	Specific Gravity		1.022	
	8	Design Temperature	Deg. C	50	
	9	Design Pressure	Kg/Cm2	5	
	10	Operating Flow	m3/Hr	120	
	11	Operating Pressure	Kg/Cm2	3.2	
	12	Operating Temperature	Deg. C	25 ~ 37	
	13	Humidity	%	5 ~ 100	
TRANSMITTER	14	Output signal type	mA	4 - 20 mA	
	15	Enclosure type number		IP 66	
	16	Elect. conn size Type		M20 X 1.5	
	17	Digital communication		HART Protocal	
	18	Signal power source		24VDc 2 Wire	
	19	Enclosure material		STAINLESS STEEL	
	20	Desplay type		LCD display	
	21	Instrument Range		–14.2 to 300 psi (–0,97 to 20,68 bar)	
SEALS	22	Seal type		Isolating Diaphragm	
	23	Process conn size		1/2 NPT female	
	24	Process conn type		Threaded	
	25	Diaphragm / Wetted Parts material		Alloy - 400 (Monel)	
	26	Mounting type		2 " Pipe Mount	
	27	Mounting Bracket		Stainless steel	
	28	Fill fluid material		Silicone Oil	
	29	Overall Acuracy		± 0.04% Of Span	
	30	Stability		±0.2% of URL for Ten years	
MISCELLANEOUS	31	Make		EMERSON PROCESS MANAGEMENT	
	32	Model Number		3051CG4A44A1KM5B4L4D4Q4	

INSTRUMENT INDEX	Measurment/ Test	Input Min Range	Input Max range	Output Min Range	Output Max range	
	Pressure Output signal	4 mA	20 mA	0 Kg/Cm2	5 Kg/Cm2	

ACCESSORIES	
	Local SS Tag Plate
	Coplanar flange bracket, all SST, 2-in. pipe and panel

PROJECT :	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS			ELECTRO CHLORINATION SYSTEM		
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED			TECHNICAL DATASHEET FOR PRESSURE TRANSMITTER		
BIDDER / VENDOR	DE NORA INDIA LIMITED			BHEL DOC. No. : PE-V11-412-174-A115		Rev
GENERAL	1	Tag No.			90PBM43CP001, 90PBM44CP001, 90PBM45CP001	
	2	Quantity			3	
	3	Service			DISCHARGE OF SHOCK DOSING PUMP	
	4	Instrument Type			COPLANAR PRESSURE TRANSMITTER	
PROCESS CONDITIONS	5	Duty			CONTINUOUS	
	6	Fluid			SEAWATER + SODIUM HYPOCHLORITE	
	7	Specific Gravity			1.022	
	8	Design Temperature		Deg. C	50	
	9	Design Pressure		Kg/Cm2	5	
	10	Operating Flow		m3/Hr	120	
	11	Operating Pressure		Kg/Cm2	3.2	
	12	Operating Temperature		Deg. C	25 ~ 37	
	13	Humidity		%	5 ~ 100	
TRANSMITTER	14	Output signal type		mA	4 - 20 mA	
	15	Enclosure type number			IP 66	
	16	Elect. conn size Type			M20 X 1.5	
	17	Digital communication			HART Protocal	
	18	Signal power source			24VDc 2 Wire	
	19	Enclosure material			STAINLESS STEEL	
	20	Desplay type			LCD display	
	21	Instrument Range			–14.2 to 300 psi (–0,97 to 20,68 bar)	
SEALS	22	Seal type			Isolating Diaphragm	
	23	Process conn size			1/2 NPT female	
	24	Process conn type			Threaded	
	25	Diaphragm / Wetted Parts material			Alloy - 400 (Monel)	
	26	Mounting type			2 " Pipe Mount	
	27	Mounting Bracket			Stainless steel	
	28	Fill fluid material			Silicone Oil	
	29	Overall Acuracy			± 0.04% Of Span	
	30	Stability			±0.2% of URL for Ten years	
MISCELLANEOUS	31	Make			EMERSON PROCESS MANAGEMENT	
	32	Model Number			3051CG4A44A1KM5B4L4D4Q4	

INSTRUMENT INDEX	Measurment/ Test	Input Min Range	Input Max range	Output Min Range	Output Max range	
	Pressure Output signal	4 mA	20 mA	0 Kg/Cm2	5 Kg/Cm2	

ACCESSORIES		
	Local SS Tag Plate	
	Coplanar flange bracket, all SST, 2-in. pipe and panel	

PROJECT :	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS			ELECTRO CHLORINATION SYSTEM		
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED			TECHNICAL DATASHEET FOR PRESSURE TRANSMITTER		
BIDDER / VENDOR	DE NORA INDIA LIMITED			BHEL DOC. No. : PE-V11-412-174-A115		Rev
GENERAL	1	Tag No.			90PBM43CP002, 90PBM44CP002	
	2	Quantity			2	
	3	Service			DISCHARGE OF SHOCK DOSING PUMP COMMON HEADER FOR UNIT- 1 / 2	
	4	Instrument Type			COPLANAR PRESSURE TRANSMITTER	
PROCESS CONDITIONS	5	Duty			CONTINUOUS	
	6	Fluid			SEAWATER + SODIUM HYPOCHLORITE	
	7	Specific Gravity			1.022	
	8	Design Temperature		Deg. C	50	
	9	Design Pressure		Kg/Cm2	5	
	10	Operating Flow		m3/Hr	240	
	11	Operating Pressure		Kg/Cm2	3.2	
	12	Operating Temperature		Deg. C	25 ~ 37	
	13	Humidity		%	5 ~ 100	
TRANSMITTER	14	Output signal type		mA	4 - 20 mA	
	15	Enclosure type number			IP 66	
	16	Elect. conn size Type			M20 X 1.5	
	17	Digital communication			HART Protocal	
	18	Signal power source			24VDc 2 Wire	
	19	Enclosure material			STAINLESS STEEL	
	20	Desplay type			LCD display	
	21	Instrument Range			–14.2 to 300 psi (–0,97 to 20,68 bar)	
SEALS	22	Seal type			Isolating Diaphragm	
	23	Process conn size			1/2 NPT female	
	24	Process conn type			Threaded	
	25	Diaphragm / Wetted Parts material			Alloy - 400 (Monel)	
	26	Mounting type			2 " Pipe Mount	
	27	Mounting Bracket			Stainless steel	
	28	Fill fluid material			Silicone Oil	
	29	Overall Acuracy			± 0.04% Of Span	
	30	Stability			±0.2% of URL for Ten years	
MISCELLANEOUS	31	Make			EMERSON PROCESS MANAGEMENT	
	32	Model Number			3051CG4A44A1KM5B4L4D4Q4	

INSTRUMENT INDEX	Measurment/ Test	Input Min Range	Input Max range	Output Min Range	Output Max range	
	Pressure Output signal	4 mA	20 mA	0 Kg/Cm2	5 Kg/Cm2	

ACCESSORIES	
	Local SS Tag Plate
	Coplanar flange bracket, all SST, 2-in. pipe and panel

PROJECT :	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS			ELECTRO CHLORINATION SYSTEM		
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED			TECHNICAL DATASHEET FOR PRESSURE TRANSMITTER		
BIDDER / VENDOR	DE NORA INDIA LIMITED			BHEL DOC. No. : PE-V11-412-174-A115		Rev
GENERAL	1	Tag No.			90PBM46CP001, 90PBM47CP001	
	2	Quantity			2	
	3	Service			DISCHARGE OF CONTINOUS DOSING PUMP AT PTP	
	4	Instrument Type			COPLANAR PRESSURE TRANSMITTER	
PROCESS CONDITIONS	5	Duty			CONTINUOUS	
	6	Fluid			SEAWATER + SODIUM HYPOCHLORITE	
	7	Specific Gravity			1.022	
	8	Design Temperature		Deg. C	50	
	9	Design Pressure		Kg/Cm2	5	
	10	Operating Flow		m3/Hr	9	
	11	Operating Pressure		Kg/Cm2	3.2	
	12	Operating Temperature		Deg. C	25 ~ 37	
	13	Humidity		%	5 ~ 100	
TRANSMITTER	14	Output signal type		mA	4 - 20 mA	
	15	Enclosure type number			IP 66	
	16	Elect. conn size Type			M20 X 1.5	
	17	Digital communication			HART Protocal	
	18	Signal power source			24VDc 2 Wire	
	19	Enclosure material			STAINLESS STEEL	
	20	Desplay type			LCD display	
	21	Instrument Range			–14.2 to 300 psi (–0,97 to 20,68 bar)	
SEALS	22	Seal type			Isolating Diaphragm	
	23	Process conn size			1/2 NPT female	
	24	Process conn type			Threaded	
	25	Diaphragm / Wetted Parts material			Alloy - 400 (Monel)	
	26	Mounting type			2 " Pipe Mount	
	27	Mounting Bracket			Stainless steel	
	28	Fill fluid material			Silicone Oil	
	29	Overall Acuracy			± 0.04% Of Span	
	30	Stability			±0.2% of URL for Ten years	
MISCELLANEOUS	31	Make			EMERSON PROCESS MANAGEMENT	
	32	Model Number			3051CG4A44A1KM5B4L4D4Q4	

INSTRUMENT INDEX	Measurment/ Test	Input Min Range	Input Max range	Output Min Range	Output Max range	
	Pressure Output signal	4 mA	20 mA	0 Kg/Cm2	5 Kg/Cm2	

ACCESSORIES		
	Local SS Tag Plate	
	Coplanar flange bracket, all SST, 2-in. pipe and panel	

PROJECT :	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS		ELECTRO CHLORINATION SYSTEM		
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED		TECHNICAL DATASHEET FOR PRESSURE TRANSMITTER		
BIDDER / VENDOR	DE NORA INDIA LIMITED		BHEL DOC. No. : PE-V11-412-174-A115		Rev
GENERAL	1	Tag No.		90PBM62CP001	
	2	Quantity		1	
	3	Service		PRESSURE AT DISCHARGE OF NEUTRALIZATION PIT PUMP	
	4	Instrument Type		IN LINE GAUGE PRESSURE TRANSMITTER	
PROCESS CONDITIONS	5	Duty		CONTINUOUS	
	6	Fluid		Nutralised Acid	
	7	Specific Gravity		1.025	
	8	Design Temperature	Deg. C	50	
	9	Design Pressure	Kg/Cm2	5	
	10	Operating Flow	m3/Hr	2	
	11	Operating Pressure	Kg/Cm2	1.2	
	12	Operating Temperature	Deg. C	25 ~ 32	
	13	Humidity	%	5 ~ 100	
TRANSMITTER	14	Output signal type	mA	4 - 20 mA	
	15	Enclosure type number		IP 66	
	16	Elect. conn size Type		M20 X 1.5	
	17	Digital communication		HART Protocal	
	18	Signal power source		24VDc 2 Wire	
	19	Enclosure material		STAINLESS STEEL	
	20	Desplay type		LCD display	
	21	Instrument Range		–14.7 to 150 psi (–1.01 to 10.34 bar)	
SEALS	22	Seal type		Isolating Diaphragm	
	23	Process conn size		1/2 NPT female	
	24	Process conn type		Threaded	
	25	Diaphragm / Wetted Parts material		Hastalloy C - 276	
	26	Mounting type		2 " Pipe Mount	
	27	Mounting Bracket		Stainless steel	
	28	Fill fluid material		Silicone Oil	
	29	Overall Acuracy		± 0.04% Of Span	
	30	Stability		±0.2% of URL for Ten years	
MISCELLANEOUS	31	Make		EMERSON PROCESS MANAGEMENT	
	32	Model Number		3051TG2A2B31KM5B4D4	

INSTRUMENT INDEX	Measurment/ Test	Input Min Range	Input Max range	Output Min Range	Output Max range	
	Pressure Output signal	4 mA	20 mA	0 Kg/Cm2	3 Kg/Cm2	

ACCESSORIES	
	Local SS Tag Plate
	Bracket for 2-in. pipe or panel mounting, all SST

PROJECT :	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS			ELECTRO CHLORINATION SYSTEM			
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED			TECHNICAL DATASHEET FOR PRESSURE TRANSMITTER			
BIDDER / VENDOR	DE NORA INDIA LIMITED			BHEL DOC. No. : PE-V11-412-174-A115			Rev
GENERAL	1	Tag No.			90PBM51CP001		
	2	Quantity			1		
	3	Service			DISCHARGE OF HCL UNLOADING PUMP		
	4	Instrument Type			IN LINE GAUGE PRESSURE TRANSMITTER		
PROCESS CONDITIONS	5	Duty			CONTINUOUS		
	6	Fluid			33% Hydrochloric Acid		
	7	Specific Gravity			1.025		
	8	Design Temperature		Deg. C	50		
	9	Design Pressure		Kg/Cm2	5		
	10	Operating Flow		m3/Hr	10		
	11	Operating Pressure		Kg/Cm2	1.5		
	12	Operating Temperature		Deg. C	25 ~ 32		
	13	Humidity		%	5 ~ 100		
TRANSMITTER	14	Output signal type		mA	4 - 20 mA		
	15	Enclosure type number			IP 66		
	16	Elect. conn size Type			M20 X 1.5		
	17	Digital communication			HART Protocal		
	18	Signal power source			24VDc 2 Wire		
	19	Enclosure material			STAINLESS STEEL		
	20	Desplay type			LCD display		
	21	Instrument Range			–14.7 to 150 psi (–1.01 to 10.34 bar)		
SEALS	22	Seal type			Isolating Diaphragm		
	23	Process conn size			1/2 NPT female		
	24	Process conn type			Threaded		
	25	Diaphragm / Wetted Parts material			Hastalloy C - 276		
	26	Mounting type			2 " Pipe Mount		
	27	Mounting Bracket			Stainless steel		
	28	Fill fluid material			Silicone Oil		
	29	Overall Acuracy			± 0.04% Of Span		
	30	Stability			±0.2% of URL for Ten years		
MISCELLANEOUS	31	Make			EMERSON PROCESS MANAGEMENT		
	32	Model Number			3051TG2A2B31KM5B4D4		
INSTRUMENT INDEX	Measurment/ Test		Input Min Range	Input Max range		Output Min Range	Output Max range
	Pressure Output signal		4 mA	20 mA		0 Kg/Cm2	2.5 Kg/Cm2
ACCESSORIES	Local SS Tag Plate						
	Bracket for 2-in. pipe or panel mounting, all SST						

PROJECT :	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS			ELECTRO CHLORINATION SYSTEM		
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED			TECHNICAL DATASHEET FOR PRESSURE TRANSMITTER		
BIDDER / VENDOR	DE NORA INDIA LIMITED			BHEL DOC. No. : PE-V11-412-174-A115		Rev
GENERAL	1	Tag No.			90PBM52CP001	
	2	Quantity			1	
	3	Service			DISCHARGE OF ACID CLEANING PUMP	
	4	Instrument Type			IN LINE GAUGE PRESSURE TRANSMITTER	
PROCESS CONDITIONS	5	Duty			CONTINUOUS	
	6	Fluid			Diluted Hydrochloric Acid	
	7	Specific Gravity			1.025	
	8	Design Temperature		Deg. C	50	
	9	Design Pressure		Kg/Cm2	5	
	10	Operating Flow		m3/Hr	20	
	11	Operating Pressure		Kg/Cm2	2	
	12	Operating Temperature		Deg. C	25 ~ 32	
	13	Humidity		%	5 ~ 100	
TRANSMITTER	14	Output signal type		mA	4 - 20 mA	
	15	Enclosure type number			IP 66	
	16	Elect. conn size Type			M20 X 1.5	
	17	Digital communication			HART Protocal	
	18	Signal power source			24VDc 2 Wire	
	19	Enclosure material			STAINLESS STEEL	
	20	Desplay type			LCD display	
	21	Instrument Range			–14.7 to 150 psi (–1.01 to 10.34 bar)	
SEALS	22	Seal type			Isolating Diaphragm	
	23	Process conn size			1/2 NPT female	
	24	Process conn type			Threaded	
	25	Diaphragm / Wetted Parts material			Hastalloy C - 276	
	26	Mounting type			2 " Pipe Mount	
	27	Mounting Bracket			Stainless steel	
	28	Fill fluid material			Silicone Oil	
	29	Overall Acuracy			± 0.04% Of Span	
	30	Stability			±0.2% of URL for Ten years	
MISCELLANEOUS	31	Make			EMERSON PROCESS MANAGEMENT	
	32	Model Number			3051TG2A2B31KM5B4D4	

INSTRUMENT INDEX	Measurment/ Test	Input Min Range	Input Max range	Output Min Range	Output Max range	
	Pressure Output signal	4 mA	20 mA	0 Kg/Cm2	3 Kg/Cm2	

ACCESSORIES	
	Local SS Tag Plate
	Bracket for 2-in. pipe or panel mounting, all SST

PROJECT :	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS			ELECTRO CHLORINATION SYSTEM			
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED			TECHNICAL DATASHEET FOR PRESSURE TRANSMITTER			
BIDDER / VENDOR	DE NORA INDIA LIMITED			BHEL DOC. No. : PE-V11-412-174-A115			Rev
GENERAL	1	Tag No.			90PBM81CP004, 90PBM82CP004		
	2	Quantity			2		
	3	Service			SUCTION OF DOSING PUMP AT SEA WATER INTAKE		
	4	Instrument Type			COPLANAR PRESSURE TRANSMITTER		
PROCESS CONDITIONS	5	Duty			CONTINUOUS		
	6	Fluid			SEAWATER + SODIUM HYPOCHLORITE		
	7	Specific Gravity			1.022		
	8	Design Temperature		Deg. C	50		
	9	Design Pressure		Kg/Cm2	5		
	10	Operating Flow		m3/Hr	12		
	11	Operating Pressure		Kg/Cm2	0.2		
	12	Operating Temperature		Deg. C	25 ~ 37		
	13	Humidity		%	5 ~ 100		
TRANSMITTER	14	Output signal type		mA	4 - 20 mA		
	15	Enclosure type number			IP 66		
	16	Elect. conn size Type			M20 X 1.5		
	17	Digital communication			HART Protocal		
	18	Signal power source			24VDc 2 Wire		
	19	Enclosure material			STAINLESS STEEL		
	20	Desplay type			LCD display		
	21	Instrument Range			–393 to 1000 inH2O (–0,97 to 2,48 bar)		
SEALS	22	Seal type			Isolating Diaphragm		
	23	Process conn size			1/2 NPT female		
	24	Process conn type			Threaded		
	25	Diaphragm / Wetted Parts material			Alloy - 400 (Monel)		
	26	Mounting type			2 " Pipe Mount		
	27	Mounting Bracket			Stainless steel		
	28	Fill fluid material			Silicone Oil		
	29	Overall Acuracy			± 0.04% Of Span		
	30	Stability			±0.2% of URL for Ten years		
MISCELLANEOUS	31	Make			EMERSON PROCESS MANAGEMENT		
	32	Model Number			3051CG3A44A1KM5B4L4D4		
INSTRUMENT INDEX	Measurment/ Test		Input Min Range	Input Max range	Output Min Range	Output Max range	
	Pressure Output signal		4 mA	20 mA	0 Kg/Cm2	1 Kg/Cm2	
ACCESSORIES	Local SS Tag Plate						
	Coplanar flange bracket, all SST, 2-in. pipe and panel						

PROJECT :	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS			ELECTRO CHLORINATION SYSTEM			
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED			TECHNICAL DATASHEET FOR PRESSURE TRANSMITTER			
BIDDER / VENDOR	DE NORA INDIA LIMITED			BHEL DOC. No. : PE-V11-412-174-A115			Rev
GENERAL	1	Tag No.			90PBM81CP003, 90PBM82CP003		
	2	Quantity			2		
	3	Service			DISCHARGE OF DOSING PUMP AT SEA WATER INTAKE		
	4	Instrument Type			COPLANAR PRESSURE TRANSMITTER		
PROCESS CONDITIONS	5	Duty			CONTINUOUS		
	6	Fluid			SEAWATER + SODIUM HYPOCHLORITE		
	7	Specific Gravity			1.022		
	8	Design Temperature		Deg. C	50		
	9	Design Pressure		Kg/Cm2	5		
	10	Operating Flow		m3/Hr	12		
	11	Operating Pressure		Kg/Cm2	3.2		
	12	Operating Temperature		Deg. C	25 ~ 37		
	13	Humidity		%	5 ~ 100		
TRANSMITTER	14	Output signal type		mA	4 - 20 mA		
	15	Enclosure type number			IP 66		
	16	Elect. conn size Type			M20 X 1.5		
	17	Digital communication			HART Protocal		
	18	Signal power source			24VDc 2 Wire		
	19	Enclosure material			STAINLESS STEEL		
	20	Desplay type			LCD display		
	21	Instrument Range			–14.2 to 300 psi (–0,97 to 20,68 bar)		
SEALS	22	Seal type			Isolating Diaphragm		
	23	Process conn size			1/2 NPT female		
	24	Process conn type			Threaded		
	25	Diaphragm / Wetted Parts material			Alloy - 400 (Monel)		
	26	Mounting type			2 " Pipe Mount		
	27	Mounting Bracket			Stainless steel		
	28	Fill fluid material			Silicone Oil		
	29	Overall Acuracy			± 0.04% Of Span		
	30	Stability			±0.2% of URL for Ten years		
MISCELLANEOUS	31	Make			EMERSON PROCESS MANAGEMENT		
	32	Model Number			3051CG4A44A1KM5B4L4D4		
INSTRUMENT INDEX	Measurment/ Test		Input Min Range	Input Max range	Output Min Range	Output Max range	
	Pressure Output signal		4 mA	20 mA	0 Kg/Cm2	4 Kg/Cm2	
ACCESSORIES	Local SS Tag Plate						
	Coplanar flange bracket, all SST, 2-in. pipe and panel						

PROJECT :	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS			ELECTRO CHLORINATION SYSTEM		
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED			TECHNICAL DATASHEET OF PRESSURE DIFFERENTIAL TRANSMITTER		
BIDDER / VENDOR	DE NORA INDIA LIMITED			BHEL DOC. No. : PE-V11-412-174-A115		Rev
GENERAL	1	Tag No.			90PBM21CP002, '90PBM22CP002	
	2	Quantity			2	
	3	Service			ACROSS SELF-CLEANING STRAINER	
	4	Instrument Type			COPLANAR DIFFERENTIAL PRESSURE TRANSMITTER	
PROCESS CONDITIONS	5	Duty			CONTINUOUS	
	6	Fluid			SEAWATER	
	7	Specific Gravity			1.020	
	8	Operating Flow		m3/Hr	150 ~ 180	
	9	Operating Pressure		Kg/Cm2	3	
	10	Operating Temperature		Deg. C	25 ~ 32	
	11	Design Temperature		Deg C	50	
	12	Design Pressure		Kg/Cm2	5	
	13	Humidity		%	5 ~ 100	
TRANSMITTER	14	Output signal type		mA	4 - 20 mA	
	15	Enclosure type number			IP 66	
	16	Elect. conn size Type			M20 X 1.5	
	17	Digital communication			HART Protocal	
	18	Signal power source			24VDc 2 Wire	
	19	Enclosure material			STAINLESS STEEL	
	20	Desplay type			LCD display	
	21	Instrument Range			–393 to 1000 inH2O (–0,97 to 2,48 bar)	
SEALS	22	Seal type			Isolating Diaphragm	
	23	Process conn size			1/2 NPT female	
	24	Process conn type			Threaded	
	25	Diaphragm / Wetted Parts material			Alloy - 400 (Monel)	
	26	Mounting type			2 " Pipe Mount	
	27	Mounting Bracket			Stainless steel	
	28	Fill fluid material			Silicone Oil	
	29	Overall Acuracy			± 0.04% Of Span	
	30	Stability			±0.2% of URL for Ten years	
MISCELLANEOUS	31	Make			EMERSON PROCESS MANAGEMENT	
	32	Model Number			3051CG3A44A1KM5B4L4D4	

INSTRUMENT INDEX	Measurment/ Test	Input Min Range	Input Max range	Output Min Range	Output Max range	
	Diff pressure Output signal	4 mA	20 mA	0 Kg/Cm2	2 Kg/Cm2	

ACCESSORIES	
	Local SS Tag Plate
	Coplanar flange bracket, all SST, 2-in. pipe and panel

PROJECT :	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS		ELECTRO CHLORINATION SYSTEM		
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED		TECHNICAL DATASHEET FOR DIFFERENTIAL PRESSURE TRANSMITTER		
BIDDER / VENDOR	DE NORA INDIA LIMITED		BHEL DOC. No. : PE-V11-412-174-A115		Rev
GENERAL	1	Tag No.		90PBM31CP002, 90PBM32CP002	
	2	Quantity		2	
	3	Service		ACROSS GENERATOR	
	4	Instrument Type		COPLANAR DIFFERENTIAL PRESSURE TRANSMITTER	
PROCESS CONDITIONS	5	Duty		CONTINUOUS	
	6	Fluid		SEAWATER/SODIUM HYPOCHLORITE	
	7	Specific Gravity		1.020	
	8	Operating Flow	m3/Hr	133.300	
	9	Operating Pressure	Kg/Cm2	2 ~ 2.5	
	10	Operating Temperature	Deg. C	25 ~ 37	
	11	Design Temperature	Deg C	50	
	12	Design Pressure	Kg/Cm2	5	
	13	Humidity	%	5 ~ 100	
TRANSMITTER	14	Output signal type	mA	4 - 20 mA	
	15	Enclosure type number		IP 66	
	16	Elect. conn size Type		M20 X 1.5	
	17	Digital communication		HART Protocal	
	18	Signal power source		24VDc 2 Wire	
	19	Enclosure material		STAINLESS STEEL	
	20	Desplay type		LCD display	
	21	Instrument Range		–393 to 1000 inH2O (–0,97 to 2,48 bar)	
SEALS	22	Seal type		Isolating Diaphragm	
	23	Process conn size		1/2 NPT female	
	24	Process conn type		Threaded	
	25	Diaphragm / Wetted Parts material		Alloy - 400 (Monel)	
	26	Mounting type		2 " Pipe Mount	
	27	Mounting Bracket		Stainless steel	
	28	Fill fluid material		Silicone Oil	
	29	Overall Acuracy		± 0.04% Of Span	
	30	Stability		±0.2% of URL for Ten years	
MISCELLANEOUS	31	Make		EMERSON PROCESS MANAGEMENT	
	32	Model Number		3051CG3A44A1KM5B4L4D4	

INSTRUMENT INDEX	Measurment/ Test	Input Min Range	Input Max range	Output Min Range	Output Max range	
	Diff pressure Output signal	4 mA	20 mA	0 Kg/Cm2	2 Kg/Cm2	

ACCESSORIES		
	Local SS Tag Plate	
	Coplanar flange bracket, all SST, 2-in. pipe and panel	

PROJECT :	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS		ELECTRO CHLORINATION SYSTEM			
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED		TECHNICAL DATASHEET FOR DIFFERENTIAL PRESSURE TRANSMITTER			
BIDDER / VENDOR	DE NORA INDIA LIMITED		BHEL DOC. No. : PE-V11-412-174-A115			Rev
GENERAL	1	Tag No.		90PBM81CP002, 90PBM82CP002		
	2	Quantity		2		
	3	Service		STRAINER DIFFERENTIAL PRESSURE AT SEA WATER INTAKE		
	4	Instrument Type		COPLANAR DIFFERENTIAL PRESSURE TRANSMITTER		
PROCESS CONDITIONS	5	Duty		CONTINUOUS		
	6	Fluid		SEAWATER/SODIUM HYPOCHLORITE		
	7	Specific Gravity		1.020		
	8	Operating Flow	m3/Hr	12		
	9	Operating Pressure	Kg/Cm2	0.5		
	10	Operating Temperature	Deg. C	25 ~ 37		
	11	Design Temperature	Deg C	50		
	12	Design Pressure	Kg/Cm2	5		
	13	Humidity	%	5 ~ 100		
TRANSMITTER	14	Output signal type	mA	4 - 20 mA		
	15	Enclosure type number		IP 66		
	16	Elect. conn size Type		M20 X 1.5		
	17	Digital communication		HART Protocal		
	18	Signal power source		24VDc 2 Wire		
	19	Enclosure material		STAINLESS STEEL		
	20	Desplay type		LCD display		
	21	Instrument Range		–393 to 1000 inH2O (–0,97 to 2,48 bar)		
SEALS	22	Seal type		Isolating Diaphragm		
	23	Process conn size		1/2 NPT female		
	24	Process conn type		Threaded		
	25	Diaphragm / Wetted Parts material		Alloy - 400 (Monel)		
	26	Mounting type		2 " Pipe Mount		
	27	Mounting Bracket		Stainless steel		
	28	Fill fluid material		Silicone Oil		
	29	Overall Acuracy		± 0.04% Of Span		
	30	Stability		±0.2% of URL for Ten years		
MISCELLANEOUS	31	Make		EMERSON PROCESS MANAGEMENT		
	32	Model Number		3051CG3A44A1KM5B4L4D4		

INSTRUMENT INDEX	Measurment/ Test	Input Min Range	Input Max range	Output Min Range	Output Max range	
	Diff pressure Output signal	4 mA	20 mA	0 Kg/Cm2	2 Kg/Cm2	

ACCESSORIES	
	Local SS Tag Plate
	Coplanar flange bracket, all SST, 2-in. pipe and panel

PROJECT :	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS			ELECTRO CHLORINATION SYSTEM		
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED			TECHNICAL DATASHEET FOR DIFFERENTIAL PRESSURE TRANSMITTER		
BIDDER / VENDOR	DE NORA INDIA LIMITED			BHEL DOC. No. : PE-V11-412-174-A115		Rev
GENERAL	1	Tag No.			90PBM40CP002, 90PBM40CP004	
	2	Quantity			2	
	3	Service			STRAINER DIFFERENTIAL PRESSURE AT SEA WATER INTAKE	
	4	Instrument Type			COPLANAR DIFFERENTIAL PRESSURE TRANSMITTER	
PROCESS CONDITIONS	5	Duty			CONTINUOUS	
	6	Fluid			SEAWATER/SODIUM HYPOCHLORITE	
	7	Specific Gravity			1.020	
	8	Operating Flow		m3/Hr	370	
	9	Operating Pressure		Kg/Cm2	0.5	
	10	Operating Temperature		Deg. C	25 ~ 37	
	11	Design Temperature		Deg C	50	
	12	Design Pressure		Kg/Cm2	5	
	13	Humidity		%	5 ~ 100	
TRANSMITTER	14	Output signal type		mA	4 - 20 mA	
	15	Enclosure type number			IP 66	
	16	Elect. conn size Type			M20 X 1.5	
	17	Digital communication			HART Protocal	
	18	Signal power source			24VDc 2 Wire	
	19	Enclosure material			STAINLESS STEEL	
	20	Desplay type			LCD display	
	21	Instrument Range			–393 to 1000 inH2O (–0,97 to 2,48 bar)	
SEALS	22	Seal type			Isolating Diaphragm	
	23	Process conn size			1/2 NPT female	
	24	Process conn type			Threaded	
	25	Diaphragm / Wetted Parts material			Alloy - 400 (Monel)	
	26	Mounting type			2 " Pipe Mount	
	27	Mounting Bracket			Stainless steel	
	28	Fill fluid material			Silicone Oil	
	29	Overall Acuracy			± 0.04% Of Span	
	30	Stability			±0.2% of URL for Ten years	
MISCELLANEOUS	31	Make			EMERSON PROCESS MANAGEMENT	
	32	Model Number			3051CG3A44A1KM5B4L4D4	

INSTRUMENT INDEX	Measurment/ Test	Input Min Range	Input Max range	Output Min Range	Output Max range	
	Diff pressure Output signal	4 mA	20 mA	0 Kg/Cm2	1 Kg/Cm2	

ACCESSORIES		
	Local SS Tag Plate	
	Coplanar flange bracket, all SST, 2-in. pipe and panel	

MODEL DESCRIPTION	
TAG NUMBER : 90PBM21CP003, 90PBM21CP004, 90PBM21CP005 , 90PBM81CP004, 90PBM82CP004	
3051CG3A44A1KM5B4L4D4Q4	
3051C	Transmitter Type: Coplanar Pressure Transmitter
G	Measurement Type: Gage
3	Pressure Upper Range Limit: CD: 1000 inH2O (2.5 bar) CG: -393 to 1000inH2O(-1.0 to 2.5 bar)
A	Transmitter Output: 4-20 mA with Digital Signal Based on HART Protocol
4	Materials of Construction: Coplanar Cast Alloy 400 Alloy 400/K-500
4	Isolating Diaphragm: Alloy 400
A	O-Ring: Glass-filled PTFE
1	Sensor Fill Fluid: Silicone
K	Housing/Conduit: SST M20 x 1.5 (CM20)
M5	Display Type: LCD Display
B4	Mounting Bracket: Coplanar Flange Bracket for 2-in. Pipe or Panel Mounting, all SST
L4	Bolting Material: Austenitic 316 SST Bolts
D4	Configuration Buttons: Analog Zero and Span
Q4	Calibration certificate
TAG NUMBER : 90PBM51CP001, 90PBM52CP001, 90PBM62CP001	
3051TG2A2B31KM5B4L4D4Q4	
3051T	Transmitter Type: Inline Pressure Transmitter
G	Measurement Type: Gage
2	Pressure Upper Range Limit: '–14.7 to 150 psi (–1,01 to 10,34 bar)
A	Transmitter Output: 4-20 mA with Digital Signal Based on HART Protocol
2B	Process connection : 1/2" NPT Female
3	Isolating Diaphragm: Alloy- C276
1	Sensor Fill Fluid: Silicone
K	Housing/Conduit: SST M20 x 1.5 (CM20)
M5	Display Type: LCD Display
B4	Mounting Bracket: Bracket for 2-in. pipe or panel mounting, all SST
L4	Bolting Material: Austenitic 316 SST Bolts
D4	Configuration Buttons: Analog Zero and Span
Q4	Calibration certificate

TAG NUMBER : 90PBM23CP001, 90PBM23CP002, 90PBM41CP001, 90PBM42CP001, 90PBM43CP001, 90PBM44CP001, 90PBM45CP001, 90PBM43CP002, 90PBM44CP002, 90PBM46CP001, 90PBM47CP001, 90PBM81CP003, 90PBM82CP003

3051CG4A44A1KM5B4L4D4Q4	
3051C	Transmitter Type: Coplanar Pressure Transmitter
G	Measurement Type: Gage
4	Pressure Upper Range Limit: CG: '–14.2 to 300 psi (–0,97 to 20,68 bar)
A	Transmitter Output: 4-20 mA with Digital Signal Based on HART Protocol
4	Materials of Construction: Coplanar Cast Alloy 400 Alloy 400/K-500
4	Isolating Diaphragm: Alloy 400
A	O-Ring: Glass-filled PTFE
1	Sensor Fill Fluid: Silicone
K	Housing/Conduit: SST M20 x 1.5 (CM20)
M5	Display Type: LCD Display
B4	Mounting Bracket: Coplanar Flange Bracket for 2-in. Pipe or Panel Mounting, all SST
L4	Bolting Material: Austenitic 316 SST Bolts
D4	Configuration Buttons: Analog Zero and Span
Q4	Calibration certificate

TAG NUMBER : '90PBM21CP002, '90PBM22CP002, 90PBM31CP002, 90PBM32CP002 '90PBM81CP002, 90PBM82CP002, '90PBM40CP002, 90PBM40CP004

3051CD3A44A1KM5B4L4D4Q4	
3051C	Transmitter Type: Pressure Transmitter
D	Measurement Type: Differential
3	Pressure Upper Range Limit: CD: 1000 inH2O (2.5 bar)
A	Transmitter Output: 4-20 mA with Digital Signal Based on HART Protocol
4	Materials of Construction: Coplanar Cast Alloy 400 Alloy 400/K-500
4	Isolating Diaphragm: Alloy 400
A	O-Ring: Glass-filled PTFE
1	Sensor Fill Fluid: Silicone
K	Housing/Conduit: SST M20 x 1.5 (CM20)
M5	Display Type: LCD Display
B4	Mounting Bracket: Coplanar Flange Bracket for 2-in. Pipe or Panel Mounting, all SST
L4	Bolting Material: Austenitic 316 SST Bolts
D4	Configuration Buttons: Analog Zero and Span
Q4	Calibration certificate

PROJECT :	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS		ELECTRO CHLORINATION SYSTEM		
PRINCIPAL CONTRACTOR	BHARAT HEAVY ELECTRICALS LIMITED		TECHNICAL DATASHEET FOR LEVEL TRANSMITTER		
BIDDER / VENDOR	DE NORA INDIA LIMITED		BHEL DOC. No. : PE-V11-412-174-A115		Rev
GENERAL	1	Tag No.		90PBM40CL003, 90PBM40CL006	
	2	Quantity		2	
	3	Service		SODIUM HYPOCHLORITE STORAGE TANK LEVEL	
	4	Type		DIFFERENTIAL PRESSURE LEVEL TRANSMITTER	
PROCESS CONDITIONS	5	Duty		CONTINUOUS	
	6	Fluid		SEAWATER + SODIUM HYPOCHLORITE	
	7	Specific Gravity		1.025	
	8	Design Temperature	Deg. C	50	
	9	Design Pressure	Kg/Cm2	5	
	10	Operating Pressure	Kg/Cm2	ATM	
	11	Operating Temperature	DEG C	25 ~ 37	
	12	Humidity	%	5 ~ 100	
	13	Vessel Height And Type	mm	7500 (tangent to tangent) (Cylindrical Vertical	
	14	Lower Material Level	mm	0	
	15	Upper Material Level	mm	6375	
TRANSMITTER	16	Output signal type	mA	4 - 20 mA	
	17	Enclosure type number		IP 66	
	18	Elect. conn size Type		1/2 " NPT	
	19	Digital communication		HART Protocal	
	20	Signal power source		24VDc 2 Wire	
	21	Isolating Diaphragm		SS316L	
	22	O- Ring		Glass-filled PTFE	
	23	Hardware Configuration		Zero and span Adj ustment	
	24	Enclosure material		STAINLESS STEEL	
	25	Display		LCD Display	
	26	Flange Adapter		1/2 " NPT	
	27	Mounting type		2 " Pipe Mount	
	28	Mounting kit material		Stainless Steel	
	29	Instrument Range Max	mmH2O	0 ~ 25400	
SEALS	30	Seal type		11 99 Remote Seal	
	31	Process conn size /material		2 in./DN 50 / SS316	
	32	Process conn typ | Style		Flush Flanged Seal	
	33	Process material		SS316	
	34	Flange Pressure Rating		Class 150 (ANSI);	
	35	Capillary Length		3 Meter	
	36	Diaphragm material		Hastalloy C -276	
	37	Capillary-armor matl		stainless steel	
	38	Bolting material		SS316	
	39	Upper housing material		SS316L	
	40	Fill fluid material		Silicone Oil 200	
PERFORMANCE	41	Accuracy		± 0.04% of span	
MISCELLANEOUS	42	MAKE		Emerson Process Management	
	43	MODEL		**3051CD3A22A1JS1B4M5D4DFQ4 + 1199WDB56AFFWG1DB00**	

INSTRUMENT INDEX	Measurment/ Test	Input Min Range	Input Max range	Output Min Range	Output Max range
	Level Scale	0 mmH2O	8500 mmH2O	4 mA	20 mA

ACCESSORIES	**SS Tag Plate with Tag no. and service Engraved**
	SS316 Nut and Bolts with 2 Nos of Washer, EPDM gasket 3mm

DE- CODING FOR DIFFERENTIAL PRESSURE LEVEL TRANSMITTER	
3051CD3A22A1JS1B4M5D4DFQ4	
3051C	Transmitter Type: Pressure Transmitter
D	Measurement Type: Differential
3	Pressure Upper Range Limit: CD/CG: 1000 inH2O (2.5 bar)
A	Transmitter Output: 4-20 mA with Digital Signal Based on HART Protocol
2	Materials of Construction: Coplanar SST SST
2	Isolating Diaphragm: 316L SST
A	O-Ring: Glass-filled PTFE
1	Sensor Fill Fluid: Silicone
j	SST 1/2 Inch NPT
S1	Diaphragm Seal Assemblies: Assemble to one Rosemount diaphragm seal
B4	Mounting Bracket: Coplanar Flange Bracket for 2-in. Pipe or Panel Mounting,all SST
M5	Display and Interface Options: LCD Display
D4	Special Configuration (Hardware): Zero and Span Hardware Adjustments
DF	Flange Adapters: 1/2-14 NPT Flange Adapters
Q4	Calibration Certification: Calibration Certificate
1199WDB56AFFWG1DB00	
1199	Type: 1199 Remote Seal
W	Welded-repairable One seal system High side of transmitter
D	Fill Fluid (Fill Fluid; Temperature: Silicone 200
B	Seal Connection Type: 0.03 in. (0.711 mm) ID
56	Capillary Connection Length: 9.8 ft. (3,0 m)
A	Industry Standard: ANSI
FFW	Process Connection Style: Flush Flanged Seal
G	Process Connection Size: 2 in./DN 50 DN 50A (JIS)
1	Flange Pressure Rating: Class 150 (ANSI); 10K (JIS)
DB	Material (Diaphragm Material; Upper: Alloy C-276 316L SST 316 SST
0	Flushing Connection Ring Material (: No Lower Housing
0	Flushing Options: No Lower Housing

Rosemount™ 3051 Pressure Transmitter

With the Rosemount 3051 Pressure Transmitter, you'll gain more control over your plant. You'll be able to reduce product variation and complexity as well as your total cost of ownership by leveraging one device across a number of pressure, level and flow applications. You'll have access to information you can use to diagnose, correct and even prevent issues. And with unparalleled reliability and experience, the Rosemount 3051 is the industry standard that will help you perform at higher levels of efficiency and safety so you can remain globally competitive.

Setting the standard for pressure measurement

Proven best-in-class performance, reliability and safety

- Over seven million installed
- Reference accuracy 0.04 percent of span
- Installed total performance of 0.14 percent of span
- 10-year stability of 0.2 percent of URL
- SIL2/3 certified (IEC 61508)

Maximize installation and application flexibility with the coplanar platform

- Improve reliability and performance with integrated DP Flowmeters, DP Level solutions and integral manifolds
- Easy installation with all solutions fully assembled, leak-tested and calibrated
- Meet your application needs with an unsurpassed offering

Advanced functionality

Power advisory diagnostics

- Detect on-scale failures caused by electrical loop issues before they impact your process operation
- This capability is safety certified for your most critical applications

Local operator interface (LOI)

- Straightforward menus and built-in configuration buttons allow you commission the device in less than a minute
- Configure in hazardous-area locations without removing the transmitter cover using external buttons

Contents

Industry leading capabilities extended to IEC 62591 (*Wireless*HART®)

- Cost effectively implement wireless on the industry's most proven platform
- Optimize safety with the industry's only intrinsically safe power module
- Eliminate wiring design and construction complexities to lower costs by 40–60 percent
- Quickly deploy new pressure, level and flow measurements in 70 percent less time

Innovative, integrated DP Flowmeters

- Fully assembled, configured, and leak tested for out-of-the-box installation
- Reduce straight pipe requirements, lower permanent pressure loss and achieve accurate measurement in small line sizes
- Up to 1.65 percent volumetric flow accuracy at 8:1 turndown

Proven, reliable, and innovative DP Level Technologies

- Connect to virtually any process with a comprehensive offering of process connections, fill fluids, direct mount or capillary connections and materials
- Quantify and optimize total system performance with QZ option
- Operate at higher temperature and in vacuum applications
- Optimize level measurement with cost efficient Rosemount Tuned-System™ Assemblies

Instrument manifolds – quality, convenient, and easy

- Designed and engineered for optimal performance with Rosemount transmitters
- Save installation time and money with factory assembly
- Offers a variety of styles, materials and configurations

Rosemount 3051C Coplanar™ Pressure Transmitter

Rosemount 3051C Coplanar Pressure Transmitters are the industry standard for differential, gage, and absolute pressure measurement. The coplanar platform enables seamless integration with manifolds, flow and level solutions. Capabilities include:

- Power advisory can proactively detect degraded electrical loop integrity issues (option code DA0)
- LOI with straightforward menus and built-in configuration buttons (option code M4)
- Safety Certification (option code QT)

Additional information:

Specifications: page 44
Certifications: page 55
Dimensional drawings: page 65

See Specifications and options for more details on each configuration. Specification and selection of product materials, options, or components must be made by the purchaser of the equipment. See page 53 for more information on Material Selection.

Table 1. Rosemount 3051C Coplanar Pressure Transmitters Ordering Information

The starred offerings (★) represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Model[1]	Transmitter type			
3051C	Coplanar pressure transmitter			
Measurement type				
D	Differential			★
G	Gage			★
A[2]	Absolute			
Pressure range				
	Differential (3051CD)	**Gage (3051CG)**	**Absolute (3051CA)**	
1	–25 to 25 inH_2O (–62,16 to 62,16 mbar)	–25 to 25 inH_2O (–62,16 to 62,16 mbar)	0 to 30 psia (0 to 2,06 bar)	★
2	–250 to 250 inH_2O (–621,60 to 621,60 mbar)	–250 to 250 inH_2O (–621,60 to 621,60 mbar)	0 to 150 psia (0 to 10,34 bar)	★
3	–1000 to 1000 inH_2O (–2,48 to 2,48 bar)	–393 to 1000 inH_2O (–0,97 to 2,48 bar)	0 to 800 psia (0 to 55,15 bar)	★
4	–300 to 300 psi (–20,68 to 20,68 bar)	–14.2 to 300 psi (–0,97 to 20,68 bar)	0 to 4000 psia (0 to 275,79 bar)	★
5	–2000 to 2000 psi (–137,89 to 137,89 bar)	–14.2 to 2000 psi (–0,97 to 137,89 bar)	N/A	★
0[3]	–3 to 3 inH_2O (-7,46 to 7,46 mbar)	N/A	N/A	
Transmitter output				
A[4]	4–20 mA with Digital Signal Based on HART® Protocol			★
F	FOUNDATION™ Fieldbus Protocol			★
W[5]	PROFIBUS® PA Protocol			★
X[6]	Wireless (requires wireless options and engineered polymer housing)			★
M[7]	Low-Power, 1–5 Vdc with Digital Signal Based on HART Protocol			

Table 1. Rosemount 3051C Coplanar Pressure Transmitters Ordering Information

The starred offerings (★) represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Materials of construction				
	Process flange type	**Flange material**	**Drain/vent**	
2	Coplanar	SST	SST	★
3[8]	Coplanar	Cast C-276	Alloy C-276	★
4	Coplanar	Alloy 400	Alloy 400/K-500	★
5	Coplanar	Plated CS	SST	★
7[8]	Coplanar	SST	Alloy C-276	★
8[8]	Coplanar	Plated CS	Alloy C-276	★
0	Alternate process connection			★
Isolating diaphragm				
2[8]	316L SST			★
3[8]	Alloy C-276			★
4[9]	Alloy 400			
5[9]	Tantalum (available on Rosemount 3051CD and CG, ranges 2–5 only; not available on Rosemount 3051CA)			
6[9]	Gold-plated alloy 400 (use in combination with O-ring option code B)			
7[9]	Gold-plated 316 SST			
O-ring				
A	Glass-filled PTFE			★
B	Graphite-filled PTFE			★
Sensor fill fluid				
1	Silicone			★
2[9]	Inert (differential and gage only)			★
Housing material			**Conduit entry size**	
A	Aluminum		1/2–14 NPT	★
B	Aluminum		M20 × 1.5	★
J	SST		1/2–14 NPT	★
K	SST		M20 × 1.5	★
P[10]	Engineered polymer		No conduit entries	★
D[11]	Aluminum		G1/2	
M[11]	SST		G1/2	

Wireless options (requires wireless output code X and Engineered Polymer Housing Code P)

Wireless transmit rate, operating frequency, and protocol		
WA3	User Configurable Transmit Rate, 2.4GHz *Wireless*HART	★
Antenna and SmartPower™		
WP5	Internal antenna, compatible with Green Power Module (I.S. Power Module sold separately)	★

Table 1. Rosemount 3051C Coplanar Pressure Transmitters Ordering Information

The starred offerings (★) represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Options (include with selected model number)

Extended product warranty		
WR3	3-year limited warranty	★
WR5	5-year limited warranty	★
PlantWeb™ control functionality[12]		
A01	FOUNDATION Fieldbus control function block suite	★
PlantWeb diagnostic functionality		
DA0[13]	Power Advisory HART Diagnostic	★
D01[12]	FOUNDATION Fieldbus Diagnostics Suite	★
Alternate flange[14]		
H2	Traditional flange, 316 SST, SST drain/vent	★
H3[8]	Traditional flange, alloy *C*, alloy *C-276* drain/vent	★
H4	Traditional flange, cast alloy 400, alloy 400/K-500 drain/vent	★
H7[8]	Traditional flange, 316 SST, alloy *C-276* drain/vent	★
HJ	DIN-compliant traditional flange,SST,7/16-in. adapter/manifold bolting	★
FA	Level flange, SST, 2-in., ANSI class 150, vertical mount 316 SST drain/vent	★
FB	Level flange, SST, 2-in., ANSI Class 300, vertical mount 316 SST drain/vent	★
FC	Level flange, SST, 3-in., ANSI Class 150, vertical mount 316 SST drain/vent	★
FD	Level flange, SST, 3-in., ANSI Class 300, vertical mount 316 SST drain/vent	★
FP	DIN level flange, SST, DN 50, PN 40, vertical mount 316 SST drain/vent	★
FQ	DIN level flange, SST, DN 80, PN 40, vertical mount 316 SST drain/vent	★
HK[15]	DIN compliant traditional flange, SST, 10 mm adapter/manifold bolting 316 SST	
HL	DIN compliant traditional flange, SST, 12 mm adapter/manifold bolting 316 SST	
Manifold assembly[16]		
S5	Assemble to Rosemount 305 Integral Manifold	★
S6	Assemble to Rosemount 304 Manifold or Connection System	★
Integral mount primary element[15][16]		
S3	Assemble to Rosemount 405 Compact Orifice Plate	★
S4[17]	Assemble to Rosemount Annubar™ or Rosemount 1195 Integral Orifice	★
Seal assemblies[16]		
S1[18]	Assemble to one Rosemount 1199 seal	★
S2[19]	Assemble to two Rosemount 1199 seals	★
Mounting bracket[20]		
B4	Coplanar flange bracket, all SST, 2-in. pipe and panel	★
B1	Traditional flange bracket, CS, 2-in. pipe	★
B2	Traditional flange bracket, CS, panel	★
B3	Traditional flange flat bracket, CS, 2-in. pipe	★
B7	Traditional flange bracket, B1 with SST bolts	★
B8	Traditional flange bracket, B2 with SST bolts	★
B9	Traditional flange bracket, B3 with SST bolts	★

Table 1. Rosemount 3051C Coplanar Pressure Transmitters Ordering Information

The starred offerings (★) represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

BA	Traditional flange bracket, B1, all SST	★
BC	Traditional flange bracket, B3, all SST	★
Product certifications		
E8	ATEX Flameproof and Dust Certification	★
I1[21]	ATEX Intrinsic Safety and Dust	★
IA	ATEX FISCO Intrinsic Safety; for FOUNDATION Fieldbus or PROFIBUS PA protocol only	★
N1	ATEX Type n Certification and Dust	★
K8	ATEX Flameproof, Intrinsic Safety, Type n, Dust (combination of E8, I1 and N1)	★
E4[22]	TIIS Flame-proof	★
E5	FM Explosion-proof, Dust Ignition-Proof	★
I5[23]	FM Intrinsically Safe, Nonincendive	★
IE	FM FISCO Intrinsically Safe; for FOUNDATION Fieldbus or PROFIBUS PA protocol only	★
K5	FM Explosion-proof, Dust Ignition-Proof, Intrinsically Safe, and Division 2	★
C6	CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, and Division 2	★
I6[10]	CSA Intrinsic Safety	★
K6	CSA and ATEX Explosion-proof, Intrinsically Safe, and Division 2 (combination of C6, E8, and I1)	★
E7	IECEx Flameproof, Dust Ignition-proof	★
I7	IECEx Intrinsic Safety	★
N7	IECEx Type n Certification	★
K7	IECEx Flame-proof, Dust Ignition-proof, Intrinsic Safety, and Type n (combination of I7, N7, and E7)	★
E2	INMETRO Flameproof	★
I2	INMETRO Intrinsic Safety	★
IB	INMETRO FISCO intrinsically safe; for FOUNDATION Fieldbus or PROFIBUS PA protocols only	★
K2	INMETRO Flameproof, Intrinsic Safety	★
E3	China Flameproof	★
I3	China Intrinsic Safety	★
N3	China Type n	★
EM	Technical Regulations Customs Union (EAC) Flameproof	★
IM	Technical Regulations Customs Union (EAC) Intrinsic Safety	★
KM	Technical Regulations Customs Union (EAC) Flameproof and Intrinsic Safety	★
KB	FM and CSA Explosion-proof, Dust Ignition Proof, Intrinsically Safe, and Division 2 (combination of K5 and C6)	★
KD	FM, CSA, and ATEX Explosion-proof, Intrinsically Safe (combination of K5, C6, I1, and E8)	★
Drinking water approval[24]		
DW	NSF drinking water approval	★
Shipboard approvals[9]		
SBS	American Bureau of Shipping	★
SBV[25]	Bureau Veritas (BV)	★
SDN	Det Norske Veritas	★
SLL[25]	Lloyds Register (LR)	★
Custody transfer[13]		
C5	Measurement Canada Accuracy Approval (limited availability depending on transmitter type and range; contact an Emerson representative)	★

Table 1. Rosemount 3051C Coplanar Pressure Transmitters Ordering Information

The starred offerings (★) represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Bolting material		
L4	Austenitic 316 SST bolts	★
L5	ASTM A 193, grade B7M bolts	★
L6	Alloy K-500 bolts	★
Display and interface options		
M4[26]	LCD display with LOI	★
M5	LCD display	★
Calibration certificate		
Q4	Calibration Certificate	★
QG[27]	Calibration Certificate and GOST Verification Certificate	★
QP	Calibration certification and tamper evident seal	★
Material traceability certification		
Q8	Material Traceability Certification per EN 10204 3.1	★
Quality certification for safety[13]		
QS	Prior-use certificate of FMEDA data	★
QT	Safety certified to IEC 61508 with certificate of FMEDA	★
Configuration buttons		
D4[13]	Analog zero and span	★
DZ[28]	Digital zero trim	★
Transient protection[9][29]		
T1	Transient protection terminal block	★
Software configuration[28]		
C1	Custom Software Configuration (For wired, see the Rosemount 3051 Configuration Data Sheet. For wireless, see the Rosemount 3051 Wireless Configuration Data Sheet.)	★
Low power output		
C2	0.8–3.2 Vdc output with Digital Signal Based on HART Protocol (available with output code M only)	★
Gage pressure calibration		
C3	Gage calibration (Rosemount 3051ca4 only)	★
Alarm levels[13]		
C4	Analog output levels compliant with NAMUR recommendation NE 43, alarm high	★
CN	Analog output levels compliant with NAMUR recommendation NE 43, alarm low	★
CR	Custom alarm and saturation signal levels, high alarm (requires C1 and Rosemount 3051 Configuration Data Sheet)	★
CS	Custom alarm and saturation signal levels, low alarm (requires C1 and Rosemount 3051 Configuration Data Sheet)	★
CT	Rosemount standard low alarm	★
Pressure testing		
P1	Hydrostatic testing with certificate	

Table 1. Rosemount 3051C Coplanar Pressure Transmitters Ordering Information

The starred offerings (★) represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Cleaning process area		
P2	Cleaning for special service	
P3	Cleaning for <1 PPM chlorine/fluorine	
Flange adapters[30]		
DF	1/2–14 NPT flange adapter(s)	★
Vent/drain valves		
D7	Coplanar flange without drain/vent ports	
Conduit plug[9][31]		
DO	316 SST conduit plug	★
RC1/4 RC1/2 process connection[32]		
D9	RC 1/4 flange with RC 1/2 flange adapter - SST	
Max static line pressure		
P9	4500 psig (310,26 bar) static pressure limit (Rosemount 3051CD Ranges 2–5 only)	★
Ground screw[9][33]		
V5	External ground screw assembly	★
Surface finish		
Q16	Surface finish certification for sanitary remote seals	★
Toolkit total system performance reports		
QZ	Remote seal system performance calculation report	★
Conduit electrical connector[9]		
GE	M12, 4-pin, male connector (eurofast®)	★
GM	A size Mini, 4-pin, male connector (minifast®)	★
NACE certificate[34]		
Q15	Certificate of Compliance to NACE MR0175/ISO 15156 for wetted materials	★
Q25	Certificate of Compliance to NACE MR0103 for wetted materials	★
Cold temperature		
BR5	–58 °F (–50 °C) cold temperature	★
BR6	–76 °F (–60 °C) cold temperature	★
HART Revision configuration (requires HART protocol output code A)[4]		
HR5	Configured for HART Revision 5	★
HR7	Configured for HART Revision 7	★
Typical model number: 3051CD 2 A 2 2 A 1 A B4		

1. Select configuration buttons (option code D4 or DZ) or LOI (option code M4) if local configuration buttons are required.
2. If ordered with Wireless output code X, only range 1–4, 316L SST diaphragm material (code 2), silicone fill fluid (code 1) and wireless housing (code P) are available.
3. Rosemount 3051CD0 is only available with output code A and X. For output code A, only process flange code 0 (Alternate flange H2, H7, HJ or HK), isolating diaphragm code 2, O ring code A and bolting option L4 are available. For output code X, only process flange code 0 (Alternate flange H2), isolating diaphragm code 2, O ring code A and bolting option L4 are available.

4. Option HR5 configures the HART output to HART Revision 5. Option HR7 configures the HART output to HART Revision 7. The device can be field configured to HART Revision 5 or 7 if desired. HART Revision 5 is the default HART output.
5. For local addressing and configuration, M4 (LOI) is required.
6. Available approvals are FM Intrinsically Safe, (option code I5), CSA Intrinsically Safe (option code I6), ATEX Intrinsic Safety (option code I1), IECEx Intrinsic Safety (option code I7) and EAC Intrinsic Safety (option code IM).
7. Only available with C6, E2, E5, I5, K5, KB and E8 product certifications. Not available with GE, GM, SBS, DA0, M4, D4, DZ, QT, HR5, HR7, CR, CS, CT.
8. Materials of Construction comply with recommendations per NACE MR0175/ISO 15156 for sour oil field production environments. Environmental limits apply to certain materials. Consult latest standard for details. Selected materials also conform to NACE MR0103 for sour refining environments.
9. Not available with wireless output (code X).
10. Only available with wireless output (code X).
11. Not available with Product certifications options E8, K8, E5, K5, C6, K6, E7, K7, E2, K2, E3, KB, KD.
12. Only valid with FOUNDATION Fieldbus output code F.
13. Only available with HART 4–20 mA output (code A).
14. Requires 0 code in materials of construction for alternate process connection.
15. Not valid with option code P9 for 4500 psi Static Pressure.
16. “Assemble-to” items are specified separately and require a completed model number.
17. Process flange limited to coplanar (option codes 2, 3, 5, 7, 8) or traditional (option codes H2, H3, H7).
18. Not valid with option code D9 for RC1/2 adapters.
19. Not valid for option codes DF and D9 for adapters.
20. Panel mounting bolts are not supplied.
21. Dust approval not applicable to output code X. See “IEC 62591 (WirelessHART Protocol)” on page 61 for wireless approvals.
22. Only available with output codes A - 4–20mA HART, F - FOUNDATION Fieldbus, and W - PROFIBUS PA. Also only available with G1/2 housing thread types.
23. Nonincendive certification not provided with Wireless output option code (X).
24. Not available with Alloy C-276 isolator (code 3), tantalum isolator (code 5), all cast C-276 flanges, all plated CS flanges, all DIN flanges, all Level flanges, assemble-to manifolds (codes S5 and S6), assemble-to seals (codes S1 and S2), assemble-to primary elements (codes S3 and S4), surface finish certification (code Q16), and remote seal system report (code QZ).
25. Only available with product certifications E7, E8, I1, I7, IA, K7, K8, KD, N1, N7
26. Not available with FOUNDATION Fieldbus (output code F), wireless (output code X), or low power (output code M).
27. Contact an Emerson representative for availability.
28. Only available with HART 4–20 mA Output (output code A) and Wireless Output (output code X)
29. The T1 option is not needed with FISCO Product Certifications; transient protection is included in the FISCO product certification codes IA, IB, and IE.
30. Not valid with Alternate Process Connection options S3, S4, S5, and S6.
31. Transmitter is shipped with a 316 SST conduit plug (uninstalled) in place of standard carbon steel conduit plug.
32. Not available with alternate process connection; DIN flanges and level flanges.
33. The V5 option is not needed with the T1 option; external ground screw assembly is included with the T1 option.
34. NACE compliant wetted materials are identified by Footnote 8.

Specifications

Performance specifications

This product data sheet covers HART, *Wireless*HART, FOUNDATION Fieldbus, and PROFIBUS PA protocols unless specified.

Conformance to specification (±3σ [Sigma])

Technology leadership, advanced manufacturing techniques, and statistical process control ensure specification conformance to at least ±3σ.

Reference accuracy

Stated reference accuracy equations include terminal based linearity, hysteresis, and repeatability. For wireless, FOUNDATION Fieldbus and PROFIBUS PA devices, use calibrated range in place of span.

Models	Rosemount 3051and *Wireless*HART
Rosemount 3051C Range 5	±0.065% of span For spans less than 10:1, accuracy = $\pm\left[0.015 + 0.005\left(\frac{URL}{Span}\right)\right]$% of Span
Ranges 2-4	± 0.04% of span(1) For spans less than 10:1(2), accuracy = $\pm\left[0.015 + 0.005\left(\frac{URL}{Span}\right)\right]$% of Span
Range 1	± 0.10% of span For spans less than 15:1, accuracy = $\pm\left[0.025 + 0.005\left(\frac{URL}{Span}\right)\right]$% of Span
Range 0 (CD)	± 0.10% of span For spans less than 2:1, accuracy = ± 0.05% of URL
Rosemount 3051CA Ranges 1–4	± 0.04% of span(1) For spans less than 10:1, accuracy = $\pm\left[0.0075\left(\frac{URL}{Span}\right)\right]$% of Span
Rosemount 3051T Ranges 1–4	± 0.04% of span(1) For spans less than 10:1, accuracy = $\pm\left[0.0075\left(\frac{URL}{Span}\right)\right]$% of Span
Range 5–6	± 0.075% of span For spans less than 10:1, accuracy = $\pm\left[0.0075\left(\frac{URL}{Span}\right)\right]$% of Span
Rosemount 3051L Ranges 2-4	± 0.075% of span For spans less than 10:1, accuracy = $\pm\left[0.025 + 0.005\left(\frac{URL}{Span}\right)\right]$% of Span

1. For output code W and M, ±0.065% span.
2. For output code F, for span less than 5:1.

Flow performance - flow reference accuracy(1)

Rosemount 3051CFA Annubar Flowmeter		
Ranges 2–3		±1.80% of flow rate at 8:1 flow turndown
Rosemount 3051CFC_A Compact Annubar Flowmeter – Rosemount Annubar option A		
Ranges 2–3	Uncalibrated	±2.10% of flow rate at 8:1 flow turndown
	Calibrated	±1.80% of Flow Rate at 8:1 flow turndown
Rosemount 3051CFC_C Compact Orifice Flowmeter – conditioning option C		
Ranges 2–3	β = 0.4	±1.75% of flow rate at 8:1 flow turndown
	β = 0.50, 0.65	±1.95% of flow rate at 8:1 flow turndown

Flow performance - flow reference accuracy[1]

Rosemount 3051CFC_P Compact Orifice Flowmeter – orifice type option P[2]		
Ranges 2–3	β = 0.4	±2.00% of flow rate at 8:1 flow turndown
	β = 0.65	±2.00% of flow rate at 8:1 flow turndown
Rosemount 3051CFP Integral Orifice Flowmeter		
Ranges 2–3	β <0.1	±3.00% of flow rate at 8:1 flow turndown
	0.1<β <0.2	±1.95% of flow rate at 8:1 flow turndown
	0.2<β <0.6	±1.75% of flow rate at 8:1 flow turndown
	0.6<β <0.8	±2.15% of flow rate at 8:1 flow turndown

1. Accuracy over range of use is always application dependent. Range 1 flowmeters may experience an additional uncertainty up to 0.9 percent. Consult your Emerson Representative for exact specifications.
2. Applicable to 2- to 12-in. line sizes. For smaller line sizes, see the Rosemount DP Flowmeters and Primary Elements Product Data Sheet.

Total performance

Total performance is based on combined errors of reference accuracy, ambient temperature effect, and static pressure effect at normal operating conditions (70 percent of span typical reading, 740 psi (51,02 bar) line pressure).

For ±50 °F (28 °C) temperature changes; 0–100% relative humidity, from 1:1 to 5:1 rangedown

Models	**Total performance[1]**
Rosemount 3051C Ranges 2–5	± 0.14% of span
Rosemount 3051T Ranges 1–4	± 0.14% of span
Rosemount 3051L Ranges 2–4	Use Instrument Toolkit™ or the QZ option to quantify the total performance of a remote seal assembly under operating conditions.

1. For output code W, F and M, total performance is ±0.15% of span.

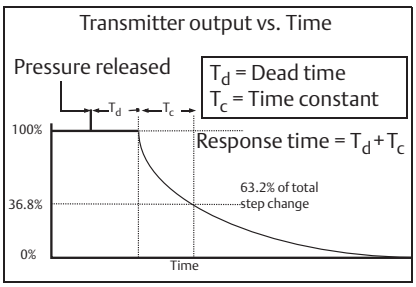
Long term stability

Models	**Long term stability**
Rosemount 3051C Ranges 2–5	±0.2% of URL for 10 years ±50 °F (28 °C) temperature changes, and up to 1000 psi (68,95 bar) line pressure.
Rosemount 3051CD, 3051CG Low/Draft Range Ranges 0–1	±0.2% of URL for 1 year
Rosemount 3051CA Low Range Range 1	±0.2% of URL for 10 years ±50 °F (28 °C) temperature changes, and up to 1000 psi (68,95 bar) line pressure.
Rosemount 3051T Ranges 1–4	±0.2% of URL for 10 years ±50 °F (28 °C) temperature changes, and up to 1000 psi (68,95 bar) line pressure.

Dynamic performance

	4 - 20 mA HART[1]	FOUNDATION Fieldbus and PROFIBUS PA protocols[3]	Typical HART transmitter response time
Total Response Time ($T_d + T_c$)[2]:			
Rosemount 3051C Ranges 2-5 Range 1 Range 0 Rosemount 3051T Rosemount 3051L	 100 ms 255 ms 700 ms 100 ms See Instrument Toolkit.	 152 ms 307 ms N/A 152 ms See Instrument Toolkit.	
Dead Time (Td)	45 ms (nominal)	97 ms	
Update Rate[4]	22 times per second	22 times per second	

1. Dead time and update rate apply to all models and ranges; analog output only.
2. Nominal total response time at 75 °F (24 °C) reference conditions.
3. Transducer block response time, Analog Input block execution time not included.
4. Does not apply to wireless (output code X). See "Wireless (output code X)" on page 51 for wireless update rate.



Line pressure effect per 1000 psi (68,95 bar)

For line pressures above 2000 psi (137,90 bar) and Ranges 4–5, see the following documents.
For HART, see the Rosemount 3051 Reference Manual. For *Wireless*HART, see the Rosemount 3051 Wireless Reference Manual.
For FOUNDATION Fieldbus, see the Rosemount 3051 Reference Manual. For PROFIBUS PA, see the Rosemount 3051 Reference Manual.

Models	Line pressure effect
Rosemount 3051CD, 3051CF	**Zero error**
Ranges 2–3	±0.05% of URL/1000 psi (68,95 bar) for line pressures from 0 to 2000 psi (0 to 137,90 bar)
Range 1	±0.25% of URL/1000 psi (68,95 bar) for line pressures from 0 to 2000 psi (0 to 137,90 bar)
Range 0	±0.125% of URL/100 psi (6,89 bar) for line pressures from 0 to 750 psi (0 to 51,71 bar)
	Span error
Ranges 2–3	±0.1% of reading/1000 psi (68,95 bar)
Range 1	±0.4% of reading/1000 psi (68,95 bar)
Range 0	±0.15% of reading/100 psi (68,95 bar)

Ambient temperature effect per 50 °F (28 °C)

Models	Ambient temperature effect
Rosemount 3051C Ranges 2–5	±(0.0125% URL + 0.0625% span) from 1:1 to 5:1 ±(0.025% URL + 0.125% span) from 5:1 to 150:1
Range 1	±(0.1% URL + 0.25% span) from 1:1 to 30:1 ±(0.14% URL + 0.15% span) from 30:1 to 50:1
Range 0	±(0.25% URL + 0.05% span) from 1:1 to 30:1
Rosemount 3051CA Ranges 1–4	±(0.025% URL + 0.125% span) from 1:1 to 30:1 ±(0.035% URL + 0.125% span) from 30:1 to 150:1
Rosemount 3051T Range 2–4	±(0.025% URL + 0.125% span) from 1:1 to 30:1 ±(0.035% URL + 0.125% span) from 30:1 to 150:1

Models	Ambient temperature effect
Range 1	±(0.025% URL + 0.125% span) from 1:1 to 10:1 ±(0.05% URL + 0.125% span) from 10:1 to 100:1
Range 5–6	±(0.1% URL + 0.15% span) from 1:1 to 5:1
Rosemount 3051L	See instrument toolkit software.

Mounting position effects

Models	Mounting position effects
Rosemount 3051C	Zero shifts up to ±1.25 inH_2O (3,11 mbar), which can be calibrated out. No span effect.
Rosemount 3051CA, 3051T	Zero shifts up to ±2.5 inH_2O (6,22 mbar), which can be calibrated out. No span effect.
Rosemount 3051L	With liquid level diaphragm in vertical plane, zero shift of up to ±1 inH_2O (2,49 mbar). With diaphragm in horizontal plane, zero shift of up to ±5 inH_2O (12,43 mbar) plus extension length on extended units. All zero shifts can be calibrated out. No span effect.

Vibration effect

Less than ±0.1% of URL when tested per the requirements of IEC60770-1: 1999 field or pipeline with high vibration level (10–60 Hz 0.21 mm displacement peak amplitude/60–2000 Hz 3g).

Power supply effect

Less than ±0.005% of calibrated span per volt change

Electromagnetic compatibility (EMC)

Meets all relevant requirements of EN61326-1:2006 and Namur NE-21.[(1)]

1. NAMUR NE-21 does not apply to wireless output code X.

Transient protection (option code T1)

Tested in accordance with IEEE C62.41.2-2002, location category B
- 6 kV crest (0.5 µs - 100 kHz)
- 3 kA crest (8 × 20 µs)
- 6 kV crest (1.2 × 50 µs)

Functional specifications

Range and sensor limits

Table 7. Rosemount 3051CD, 3051CG, 3051CF, and 3051L Range and Sensor Limits

Range[1]	Minimum span	Range and sensor limits				
			Lower (LRL)			
	Rosemount 3051CD, 3051CG, 3051CF, 3051L[2]	Upper (URL)	Rosemount 3051CD differential, 3051CF Flowmeters	Rosemount 3051CG gage[3]	Rosemount 3051L differential	Rosemount 3051L gage[3]
0	0.10 inH_2O (0,24 mbar)	3.00 inH_2O (7,45 mbar)	–3.00 inH_2O (–7,45 mbar)	N/A	N/A	N/A
1	0.50 inH_2O (1,24 mbar)	25.00 inH_2O (62,16 mbar)	–25.00 inH_2O (–62,16 mbar)	–25.00 inH_2O (–62,16 mbar)	N/A	N/A
2	1.67 inH_2O (4,15 mbar)	250.00 inH_2O (621,60 mbar)	–250.00 inH_2O (–621,60 mbar)	–250.00 inH_2O (–621,60 mbar)	–250.00 inH_2O (–621,60 mbar)	–250.00 inH_2O (–621,60 mbar)
3	6.67 inH_2O (16,58 mbar)	1000.00 inH_2O (2,48 bar)	–1000.00 inH_2O (–2,48 bar)	0.50 psia (34,47 mbar)	–1000.00 inH_2O (–2,48 bar)	0.50 psia (34,47 mbar)
4	2.00 psi (137,89 mbar)	300.00 psi (20,68 bar)	–300.00 psi (–20,68 bar)	0.50 psia (34,47 mbar)	–300.00 psi (–20,68 bar)	0.50 psia (34,47 mbar)
5	13.33 psi (919,01 mbar)	2000.00 psi (137,89 bar)	– 2000.00 psi (–137,89 bar)	0.50 psia (34,47 mbar)	N/A	N/A

1. Range 0 only available with Rosemount 3051CD. Range 1 only available with 3051CD, 3051CG, or 3051CF. inH_2O referenced at 68 degrees Fahrenheit.
2. For outputs options W and M, minimum span are: range 1 - 0.50 inH_2O (1,24 mbar), range 2 - 2.50 inH_2O (6,21 mbar), range 3 - 10.00 inH_2O (24,86 mbar), range 4 - 3.00 psi (0,21 bar), range 5 - 20.00 psi (1,38 bar).
3. Assumes atmospheric pressure of 14.7 psig.

Table 8. Rosemount 3051CA and 3051T Range and Sensor Limits

Range	Rosemount 3051CA			Range	Rosemount 3051T			
	Minimum span[1]	Range and sensor limits			Minimum span[1]	Range and sensor limits		
		Upper (URL)	Lower (LRL)			Upper (URL)	Lower (LRL) (absolute)	Lower[2] (LRL) (gage)
1	0.30 psi (20,68 mbar)	30 psia (2,06 bar)	0 psia (0 bar)	1	0.30 psi (20,68 mbar)	30.00 psi (2,06 bar)	0 psia (0 bar)	–14.70 psig (–1,01 bar)
2	1.00 psi (68,94 mbar)	150 psia (10,34 bar)	0 psia (0 bar)	2	1.00 psi (68,94 mbar)	150.00 psi (10,34 bar)	0 psia (0 bar)	–14.70 psig (–1,01 bar)
3	5.33 psi (367,49 mbar)	800 psia (55,15 bar)	0 psia (0 bar)	3	5.33 psi (367,49 mbar)	800.00 psi (55,15 bar)	0 psia (0 bar)	–14.70 psig (–1,01 bar)
4	26.67 psi (1,83 bar)	4000 psia (275,79 bar)	0 psia (0 bar)	4	26.67 psi (1,83 bar)	4000.00 psi (275,79 bar)	0 psia (0 bar)	–14.70 psig (–1,01 bar)
5	N/A	N/A	N/A	5	2000.00 psi (137,89 bar)	10000.00 psi (689,47 bar)	0 psia (0 bar)	–14.70 psig (–1,01 bar)
6	N/A	N/A	N/A	6	4000.00 psi (275,79 bar)	20000.00 psi (1378,95 bar)	0 psia (0 bar)	–14.70 psig (–1,01 bar)

1. For output options W and M, minimum span are: range 2 – 1.50 psi(0,10 bar), range 3 – 8.00 psi (0,55 bar), range 4 – 40.00 psi (2,75 bar), range 5 for 3051T – 2000.00 psi (137,89 bar)
2. Assumes atmospheric pressure of 14.7 psig.

Service

Liquid, gas, and vapor applications

4–20 mA HART (output code A)

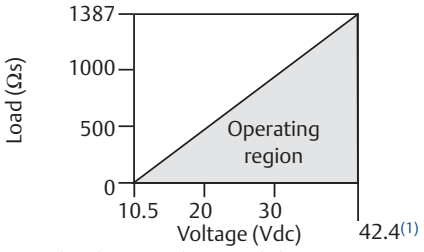
Power supply

External power supply required. Standard transmitter (4–20mA) operates on 10.5–42.4 Vdc with no load.

Load limitations

Maximum loop resistance is determined by the voltage level of the external power supply described by:

Max. Loop Resistance = 43.5 (Power Supply Voltage – 10.5)



Communication requires a minimum loop resistance of 250 ohms.

1. For CSA approval, power supply must not exceed 42.4 V.

Indication

Optional 2-line LCD/LOI Display

Optional configuration buttons

Configuration buttons need to be specified:
Digital Zero trim (option code DZ) changes digital value of the transmitter and is used for performing a sensor zero trim.
Analog Zero Span (option code D4) changes analog value and can be used to rerange the transmitter with an applied pressure.

Output

Two-wire 4–20mA, user selectable for linear or square root output. Digital process variable superimposed on 4–20 mA signal, available to any host that conforms to HART protocol. The 3051 comes with Selectable HART Revisions. Digital communications based on HART Revision 5 (default) or Revision 7 (option code HR7) protocol can be selected. The HART revision can be switched in the field using any HART based configuration tool or the optional LOI (M4).

Power advisory diagnostics

Power Advisory Diagnostics pro-actively detect and notify you of degraded electrical loop integrity before it can affect your process operation. Example loop problems that can be detected include water in the terminal compartment, corrosion of terminals, improper grounding, and unstable power supplies. The device dashboard presents the diagnostics in a graphical, task-based interface that provides single-click access to critical process/device information and descriptive graphical troubleshooting.

LOI

The LOI utilizes a 2 button menu with internal and external configuration buttons. Internal buttons are always configured for LOI. External buttons can be configured for either LOI (option code M4), Analog Zero and Span (option code D4) or Digital Zero Trim (option code DZ). See Rosemount 3051 Reference Manual for LOI configuration menu.

FOUNDATION Fieldbus (output code F)

Power supply

External power supply required; transmitters operate on 9.0 to 32.0 Vdc transmitter terminal voltage. FISCO transmitters operate on 9.0 to 17.5 Vdc.

Current draw

17.5 mA for all configurations (including LCD display option)

Indication

Optional 2-line LCD display

FOUNDATION Fieldbus block execution times

Block	Execution time
Resource	N/A
Sensor and SPM Transducer	N/A
LCD Display	N/A
Analog Input 1, 2	20 milliseconds
PID	25 milliseconds
Input Selector	20 milliseconds
Arithmetic	20 milliseconds
Signal Characterizer	20 milliseconds
Integrator	20 milliseconds
Output Splitter	20 milliseconds
Control Selector	20 milliseconds

FOUNDATION Fieldbus parameters

Links	25 (max.)
Virtual communications relationships (VCR)	20 (max.)

FOUNDATION Fieldbus function blocks (option A01)

Resource block

The resource block contains diagnostic, hardware, and electronics information. There are no linkable inputs or outputs to the Resource Block.

Sensor transducer block

The sensor transducer block contains sensor information and the ability to calibrate the pressure sensor or recall factory calibration.

LCD transducer block

The LCD display transducer block is used to configure the LCD display meter.

Analog input block

The analog input (AI) function block processes the measurements from the sensor and makes them available to other function blocks. The output value from the AI block is in engineering units and contains a status indicating the quality of the measurement. The AI Block is widely used for scaling functionality.

Input selector block

The input selector (ISEL) function block can be used to select the first good, hot backup, maximum, minimum, or average of as many as eight input values and place it at the output. The block supports signal status propagation.

Integrator block

The integrator (INT) function block integrates one or two variables over time. The block compares the integrated or accumulated value to pre-trip and trip limits and generates discrete output signals when the limits are reached.
The INT function block is used as a totalizer. This block will accept up to two inputs, has six options how to totalize the inputs, and two trip outputs.

Arithmetic block

The arithmetic (ARTH) function block provides the ability to configure a range extension function for a primary input. It can also be used to compute nine different arithmetic functions including flow with partial density compensation, electronic remote seals, hydrostatic tank gaging, ratio control, and others.

Signal characterizer block

The signal characterizer (SGCR) function block characterizes or approximates any function that defines an input/output relationship. The function is defined by configuring as many as twenty X,Y coordinates. The block interpolates an output value for a given input value using the curve defined by the configured coordinates. Two separate analog input signals can be processed simultaneously to give two corresponding separate output values using the same defined curve.

PID block

The PID function block combines all of the necessary logic to perform proportional/integral/derivative (PID) control. The block supports mode control, signal scaling and limiting, feed forward control, override tracking, alarm limit detection, and signal status propagation.

Control selector block

The control selector function block selects one of two or three inputs to be the output. The inputs are normally connected to the outputs of PID or other function blocks. One of the inputs would be considered normal and the other two overrides.

Output splitter block

The output splitter function block provides the capability to drive two control outputs from a single input. It takes the output of one PID or other control block to control two valves or other actuators.

Backup Link Active Scheduler (LAS)

The transmitter can function as a Link Active Scheduler if the current link master device fails or is removed from the segment.

FOUNDATION Fieldbus Diagnostics Suite (option code D01)

The Rosemount 3051C FOUNDATION Fieldbus Diagnostics Suite features SPM technology to detect changes in the process, process equipment, or installation conditions (such as plugged impulse lines) of the transmitter. This is done by modeling the process noise signature (using the statistical values of mean and standard deviation) under normal conditions and then comparing the baseline values to current values over time. If a significant change in the current values is detected, the transmitter can generate an alert.

PROFIBUS PA (output code W)

Profile version

3.02

Power supply

External power supply required; transmitters operate on 9.0 to 32.0 Vdc transmitter terminal voltage. FISCO transmitters operate on 9.0 to 17.5 Vdc.

Current draw

17.5 mA for all configurations (including LCD display option)

Output update rate

Four times per second

Standard function blocks

Analog input (AI block)

The AI function block processes the measurements and makes them available to the host device. The output value from the AI block is in engineering units and contains a status indicating the quality of the measurement.

Physical block

The physical block defines the physical resources of the device including type of memory, hardware, electronics and diagnostic information.

Transducer block

Contains actual sensor measurement data including the sensor diagnostics and the ability to trim the pressure sensor or recall factory defaults.

Indication

Optional 2-line LCD display

LOI

The LOI utilizes a 2-button menu with external configuration buttons.

Wireless (output code X)

Output

IEC 62591 (*Wireless*HART), 2.4 GHz DSSS

Wireless radio (internal antenna, WP5 option)

- Frequency: 2.400 – 2.485 GHz
- Channels: 15
- Modulation: IEEE 802.15.4 compliant DSSS
- Transmission: Maximum of 10 dBm EIRP

Local display

The optional 3-line, 7-digit LCD display can display user-selectable information such as primary variable in engineering units, scaled variable, percent of range, sensor module temperature, and electronics temperature. The display updates based on the wireless update rate.

Digital zero trim

Digital zero trim (option DZ) is an offset adjustment to compensate for mounting position effects, up to 5% of URL.

Update rate

User selectable 1 sec. to 60 min.

Wireless sensor module for in-line transmitters

The Rosemount 3051 Wireless Transmitter requires the engineered polymer housing to be selected. The standard sensor module will come with aluminum material. If stainless steel is required, the option WSM must be selected.

Power module

Field replaceable, keyed connection eliminates the risk of incorrect installation, Intrinsically Safe Lithium-thionyl chloride Power Module with PBT/PC enclosure. Ten-year life at one minute update rate.(1)

1. *Reference conditions are 70 °F (21 °C), and routing data for three additional network devices.*

Note
Continuous exposure to ambient temperature limits of -40 °F or 185 °F (–40 °C or 85 °C) may reduce specified life by less than 20 percent.

Low power output

1–5 Vdc HART Low Power (output code M)

Output

Three-wire 1–5 Vdc (option code C2) user-selectable output. Also user selectable for linear or square root output configuration. Digital process variable superimposed on voltage signal, available to any host conforming to the HART protocol. Low-power transmitter operates on 6–12 Vdc with no load.

Power consumption

3.0 mA, 18–36 mW

Minimum load impedance

100 kΩ (V_{out} wiring)

Indication

Optional 5-digit LCD display

Overpressure limits

Rosemount 3051CD/CG/CF

- Range 0: 750 psi (51,71 bar)
- Range 1: 2000 psig (137,90 bar)
- Ranges 2–5: 3626 psig (250,00 bar)
  4500 psig (310,26 bar) for option code P9

Rosemount 3051CA

- Range 1: 750 psia (51,71 bar)
- Range 2: 1500 psia (103,42 bar)
- Range 3: 1600 psia (110,32 bar)
- Range 4: 6000 psia (413,69 bar)

Rosemount 3051TG/TA

- Range 1: 750 psi (51,71 bar)
- Range 2: 1500 psi (103,42 bar)
- Range 3: 1600 psi (110,32 bar)
- Range 4: 6000 psi (413,69 bar)
- Range 5: 15000 psi (1034,21 bar)
- Range 6: 24000 psi (1654,74 bar)

For Rosemount 3051L or level flange option codes FA, FB, FC, FD, FP, and FQ, limit is 0 psia to the flange rating or sensor rating, whichever is lower.

Table 9. Rosemount 3051L and Level Flange Rating Limits

Standard	Type	CS rating	SST rating
ANSI/ASME	Class 150	285 psig	275 psig
ANSI/ASME	Class 300	740 psig	720 psig
ANSI/ASME	Class 600	1480 psig	1440 psig
At 100 °F (38 °C), the rating decreases with increasing temperature, per ANSI/ASME B16.5.			
DIN	PN 10–40	40 bar	40 bar
DIN	PN 10/16	16 bar	16 bar
DIN	PN 25/40	40 bar	40 bar
At 248 °F (120 °C), the rating decreases with increasing temperature, per DIN 2401.			

Static pressure limit

Rosemount 3051CD only

Operates within specifications between static line pressures of 0.5 psia and 3626 psig (4500 psig (310, 26 bar) for option code P9).
Range 0: 0.5 psia and 750 psig (0,03 bar and 51,71 bar)
Range 1: 0.5 psia and 2000 psig (0,03 bar and 137, 90 bar)

Burst pressure limits

Rosemount 3051C, 3051CF Coplanar or Traditional process flange

10081 psig (695,06 bar)

Rosemount 3051T In-Line

Ranges 1–4: 11016 psi (759,53 bar)
Range 5: 26016 psig (1793,74 bar)

Range 6: 46092 psi (3177,93 bar)

Failure mode alarm

HART 4–20 mA (output option code A)

If self-diagnostics detect a sensor or microprocessor failure, the analog signal is driven either high or low to alert the user. High or low failure mode is user-selectable with a jumper/switch on the transmitter. The values to which the transmitter drives its output in failure mode depend on whether it is configured to standard, NAMUR-compliant, or custom levels (see alarm configuration below). The values for each are as follows:

	High alarm	Low alarm
Default	≥ 21.75 mA	≤ 3.75 mA
NAMUR compliant(1)	≥ 22.5 mA	≤ 3.6 mA
Custom levels(2)	20.2 – 23.0 mA	3.4 – 3.8 mA

1. Analog output levels are compliant with NAMUR recommendation NE 43, see option codes C4 or C5.
2. Low alarm must be 0.1 mA less than low saturation and high alarm must be 0.1 mA greater than high saturation.

Output code M

If self-diagnostics detect a gross transmitter failure, the analog signal will be driven either below 0.94 V or above 5.4 V to alert the user (below 0.75 V or above 4.4 V for Option C2). High or low alarm signal is user-selectable by internal jumper.

Output code F, W, and X

If self-diagnostics detect a gross transmitter failure, that information gets passed as an alert and a status along with the process variable.

Temperature limits

Ambient

–40 to 185 °F (–40 to 85 °C)
With LCD display(1)(2): –40 to 176 °F (–40 to 80 °C)

1. *For the output code M and W, LCD display may not be readable and LCD display updates will be slower at temperatures below –22 °F (–30 °C).*
2. *Wireless LCD display may not be readable and LCD display updates will be slower at temperature below –4 °F (–20 °C).*

Storage(1)

–50 to 230 °F (–46 to 110 °C)
With LCD display: –40 to 185 °F (–40 to 85 °C)
With Wireless Output: –40 °F to 185 °F (–40 °C to 85 °C)

1. *If storage temperature is above 85 °C, perform a sensor trim prior to installation.*

Process

At atmospheric pressures and above. See Table 10.

Table 10. 3051 Process Temperature Limits

Rosemount 3051CD, 3051CG, 3051CF, 3051CA	
Silicone fill sensor(1)	
with Coplanar flange	–40 to 250 °F (–40 to 121 °C)(2)
with Traditional flange	–40 to 300 °F (–40 to 149 °C)(2)(3)
with Level flange	–40 to 300 °F (–40 to 149 °C)(2)
with 305 Integral Manifold	–40 to 300 °F (–40 to 149 °C)(2)
Inert fill sensor(1)(4)	–40 to 185 °F (–40 to 85 °C)(5)(6)
Rosemount 3051T (process fill fluid)	
Silicone fill sensor(1)	–40 to 250 °F (–40 to 121 °C)(2)
Inert fill sensor(1)	–22 to 250 °F (–30 to 121 °C)(2)
Rosemount 3051L low-side temperature limits	
Silicone fill sensor(1)	–40 to 250 °F (–40 to 121 °C)(2)
Inert fill sensor(1)	–40 to 185 °F (–40 to 85 °C)(5)
Rosemount 3051L high-side temperature limits (process fill fluid)	
SYLTHERM XLT	–102 to 293 °F (–75 to 145 °C)
D.C. Silicone 704	32 to 401 °F (0 to 205 °C)
D.C. Silicone 200	–49 to 401 °F (–45 to 205 °C)
Inert	–49 to 320 °F (–45 to 160 °C)
Glycerin and water	5 to 203 °F (–15 to 95 °C)
Neobee M-20	5 to 401 °F (–15 to 205 °C)
Propylene glycol and Water	5 to 203 °F (–15 to 95 °C)

1. Process temperatures above 185 °F (85 °C) require derating the ambient limits by a 1.5:1 ratio.
2. 220 °F (104 °C) limit in vacuum service; 130 °F (54 °C) for pressures below 0.5 psia.
3. Rosemount 3051CD0 process temperature limits are –40 to 212 °F (–40 to 100 °C).
4. Inert fill with Traditional flange on Range 0: limits are 32 to 185 °F (0 to 85 °C).
5. 160 °F (71 °C) limit in vacuum service.
6. Not available for Rosemount 3051CA.

Humidity limits

0–100 percent relative humidity

Turn-on time

Performance within specifications less than 2.0 seconds (20.0 seconds for PROFIBUS PA and FOUNDATION Fieldbus protocols) after power is applied to the transmitter.(1)

1. *Does not apply to wireless option code X.*

Volumetric displacement

Less than 0.005-in^3 (0,08 cm^3)

Damping

4–20 mA HART

Analog output response to a step input change is user-enterable from 0.0 to 60 seconds for one time constant. This software damping is in addition to sensor module response time.

FOUNDATION Fieldbus

Transducer block: User configurable
AI Block: User configurable

PROFIBUS PA

AI Block only: User configurable

Physical specifications

Material selection

Emerson provides a variety of Rosemount products with various product options and configurations including materials of construction that can be expected to perform well in a wide range of applications. The Rosemount product information presented is intended as a guide for the purchaser to make an appropriate selection for the application. It is the purchaser's sole responsibility to make a careful analysis of all process parameters (such as all chemical components, temperature, pressure, flow rate, abrasives, contaminants, etc.), when specifying product materials, options, and components for the particular application. Emerson Process Management is not in a position to evaluate or guarantee the compatibility of the process fluid or other process parameters with the product options, configuration, or materials of construction selected.

Electrical connections

1/2–14 NPT, G1/2, and M20 × 1.5 conduit. The polymer housing code P) has no conduit entries. HART interface connections fixed to terminal block for output code A and to 701P Power Module for output code X.

Process connections

Rosemount 3051C

1/4–18 NPT on 2 1/8-in. centers
1/2–14 NPT on 2-, 2 1/8-, or 2 1/4-in. centers

Rosemount 3051L

High pressure side: 2-, 3-, or 4-in., ASME B 16.5 (ANSI) Class 150, 300 or 600 flange; 50, 80 or 100 mm, PN 40 or 10/16 flange
Low pressure side: 1/4–18 NPT on flange 1/2–14 NPT on adapter

Rosemount 3051T

1/2–14 NPT female
G1/2A DIN 16288 Male (range 1–4 only)
Autoclave type F-250-C (Pressure relieved 9/16–18 gland thread; 1/4 OD high pressure tube 60° cone; available for range 5–6 transmitters only).

Rosemount 3051CF

For Rosemount 3051CFA, see Rosemount 485 Annubar Product Data Sheet.
For Rosemount 3051CFC, see Rosemount 405 Compact Orifice Plate Product Data Sheet.
For Rosemount 3051CFP, see Rosemount 1195 Integral Orifice Product Data Sheet.

Process-wetted parts

Drain/vent valves

316 SST, Alloy C-276, or Alloy 400 material (Alloy 400 not available with 3051L)

Process flanges and adapters

Plated carbon steel
SST: CF-8M (Cast 316 SST) per ASTM A743
Cast C-276: CW-12MW per ASTM A494
Cast Alloy 400: M-30C per ASTM A494

Wetted O-rings

Glass-filled PTFE or graphite-filled PTFE

Process isolating diaphragms

Isolating diaphragm material	3051CD 3051CG	3051T	3051CA
316L SST (UNS S31603)	•	•	•
Alloy C-276 (UNS N10276)	•	•	•
Alloy 400 (UNS N04400)	•	N/A	•
Tantalum (UNS R05440)	•	N/A	N/A
Gold-plated Alloy 400	•	N/A	•
Gold-plated 316L SST	•	N/A	•

Rosemount 3051L process wetted parts

Flanged process connection (transmitter high side)

Process diaphragms, including process gasket surface

316L SST, Alloy C-276, or Tantalum

Extension

CF-3M (Cast version of 316L SST, material per ASTM-A743), or Alloy C-276. Fits schedule 40 and 80 pipe.

Mounting flange

Zinc-cobalt plated CS or SST

Reference process connection (transmitter low side)

Isolating diaphragms

316L SST or Alloy C-276

Reference flange and adapter

CF-8M (cast version of 316 SST, material per ASTM-A743)

Non-wetted parts

Electronics housing

Low-copper aluminum or CF-8M (cast version of 316 SST)
Enclosure type 4X, IP 65, IP 66, IP 68
Housing material code P: PBT/PC with NEMA 4X and IP66/67/68

Coplanar sensor module housing

SST: CF-3M (Cast 316L SST)

Bolts

Plated carbon steel per ASTM A449, Type 1
Austenitic 316 SST per ASTM F593
ASTM A193, Grade B7M alloy steel
Alloy K-500

Sensor module fill fluid

Coplanar: Silicone or Inert Halocarbon
In-line: Silicone or Fluorinert™ FC-43

Process fill fluid (3051L only)

SYLTHERM XLT, D.C. Silicone 704, D.C. Silicone 200, inert, glycerin and water, Neobee M-20, or propylene glycol and water

Paint

Polyurethane

Cover O-rings

Buna-N
Silicone (for wireless option code X)

Power module

Field replaceable, keyed connection eliminates the risk of incorrect installation, Intrinsically Safe Lithium-thionyl chloride Power Module with PBT enclosure.

Shipping weights

Table 11. Transmitter Weights without Options[1]

Transmitter	Rosemount 3051 In lb. (kg)	Wireless In lb. (kg)
3051C	6.0 (2,7)	3.9 (1,8)
3051T	3.0 (1,4)	1.9 (0,86)
3051L	Table 12	Table 12

1. Transmitter weights include the sensor module and housing only (aluminum for Rosemount 3051 and polymer for wireless).

Table 12. Rosemount 3051L Weights without Options

Flange	Flush lb. (kg)	2-in. Ext. lb. (kg)	4-in. Ext. lb. (kg)	6-in. Ext. lb. (kg)
2-in., 150	12.5 (5,7)	N/A	N/A	N/A
3-in., 150	17.5 (7,9)	19.5 (8,8)	20.5 (9,3)	21.5 (9,7)
4-in., 150	23.5 (10,7)	26.5 (12,0)	28.5 (12,9)	30.5 (13,8)
2-in., 300	17.5 (7,9)	N/A	N/A	N/A
3-in., 300	22.5 (10,2)	24.5 (11,1)	25.5 (11,6)	26.5 (12,0)
4-in., 300	32.5 (14,7)	35.5 (16,1)	37.5 (17,0)	39.5 (17,9)
2-in., 600	15.3 (6,9)	N/A	N/A	N/A
3-in., 600	25.2 (11,4)	27.2 (12,3)	28.2 (12,8)	29.2 (13,2)
DN 50/ PN 40	13.8 (6,2)	N/A	N/A	N/A
DN 80/ PN 40	19.5 (8,8)	21.5 (9,7)	22.5 (10,2)	23.5 (10,6)
DN 100/ PN 10/16	17.8 (8,1)	19.8 (9,0)	20.8 (9,5)	21.8 (9,9)
DN 100/ PN 40	23.2 (10,5)	25.2 (11,5)	26.2 (11,9)	27.2 (12,3)

Table 13. Transmitter Option Weights

Code	Option	Add lb. (kg)
J, K, L, M	Stainless steel housing (T)	3.9 (1,8)
J, K, L, M	Stainless steel housing (C, L, H, P)	3.1 (1,4)
M4/M5	LCD display for wired transmitter	0.5 (0,2)
M5	LCD display for wireless output	0.1 (0,04)
B4	SST mounting bracket for coplanar flange	1.0 (0,5)
B1, B2, B3	Mounting bracket for traditional flange	2.3 (1,0)
B7, B8, B9	Mounting bracket for traditional flange	2.3 (1,0)
BA, BC	SST bracket for traditional flange	2.3 (1,0)
H2	Traditional flange	2.4 (1,1)
H3	Traditional flange	2.7 (1,2)
H4	Traditional flange	2.6 (1,2)
H7	Traditional flange	2.5 (1,1)
FC	Level flange—3 in., 150	10.8 (4,9)
FD	Level flange—3 in., 300	14.3 (6,5)
FA	Level flange—2 in., 150	10.7 (4,8)
FB	Level flange—2 in., 300	14.0 (6,3)
FP	DIN level flange, SST, DN 50, PN 40	8.3 (3,8)
FQ	DIN level flange, SST, DN 80, PN 40	13.7 (6,2)
WSM	SST sensor module	1.0 (0,45)
	Power Module (701PGNKF)	0.4 (0,18)

Product Certifications

Rosemount 3051

Rev 1.6

European Directive Information

A copy of the EU Declaration of Conformity can be found at the end of the Quick Start Guide. The most recent revision of the EU Declaration of Conformity can be found at Emerson.com/Rosemount.

Ordinary Location Certification

As standard, the transmitter has been examined and tested to determine that the design meets the basic electrical, mechanical, and fire protection requirements by FM Approvals, a nationally recognized test laboratory (NRTL) as accredited by the Federal Occupational Safety and Health Administration (OSHA).

USA

E5 USA Explosionproof (XP) and Dust-Ignitionproof (DIP)
Certificate: 0T2H0.AE
Standards: FM Class 3600 – 2011, FM Class 3611 – 2004, FM Class 3810 – 2005, ANSI/NEMA 250 – 2008
Markings: IS CL I, DIV 1, GP B, C, D; DIP CL II, DIV 1, GP E, F, G; CL III; T5(–50 °C ≤ T_a ≤ +85 °C); Factory Sealed; Type 4X

I5 USA Intrinsic Safety (IS) and Nonincendive (NI)
Certificate: FM16US0120X
Standards: FM Class 3600 – 2011, FM Class 3610 – 2010, FM Class 3611 – 2004, FM Class 3810 – 2005, ANSI/NEMA 250 – 2008
Markings: IS CL I, DIV 1, GP A, B, C, D; CL II, DIV 1, GP E, F, G; Class III; DIV 1 when connected per Rosemount drawing 03031-1019; NI CL 1, DIV 2, GP A, B, C, D; T4(–50 °C ≤ T_a ≤ +70 °C) [HART], T5(–50 °C ≤ T_a ≤ +40 °C) [HART]; T4(–50 °C ≤ T_a ≤ +60 °C) [Fieldbus/PROFIBUS]; Type 4x

Special Conditions for Safe Use (X):

1. The Rosemount 3051 transmitter housing contains aluminum and is considered a potential risk of ignition by impact or friction. Care must be taken into account during installation and use to prevent impact and friction.
2. The Rosemount 3051 transmitter with the transient terminal block (option code T1) will not pass the 500 Vrms dielectric strength test and this must be taken into account during installation.

IE USA FISCO
Certificate: FM16US0120X
Standards: FM Class 3600 – 2011, FM Class 3610 – 2010, FM Class 3611 – 2004, FM Class 3810 – 2005
Markings: IS CL I, DIV 1, GP A, B, C, D when connected per Rosemount drawing 03031-1019 (–50 °C ≤ T_a ≤ +60 °C); Type 4x

Special Conditions for Safe Use (X):

1. The Rosemount 3051 transmitter housing contains aluminum and is considered a potential risk of ignition by impact or friction. Care must be taken into account during installation and use to prevent impact and friction.
2. The Rosemount 3051 transmitter with the transient terminal block (option code T1) will not pass the 500Vrms dielectric strength test and this must be taken into account during installation.

C6 Canada Explosionproof, Dust-Ignitionproof, Intrinsic Safety and Nonincendive
Certificate: 1053834
Standards: ANSI/ISA 12.27.01-2003, CSA Std. C22.2 No. 30 -M1986, C SA Std. C22.2 No.142-M1987, CSA Std. C22.2. No.157-92, CSA Std. C22.2 No. 213 - M1987, CAN/CSA C22.2 No. 0-10, CSA Std C22.2 No. 25-1966, CAN/CSA-C22.2 No. 94-M91, CAN/CSA-E60079-0-07, CAN/CSA-E60079-1-07
Markings: Explosionproof for Class I, Division 1, Groups B, C and D; Suitable for Class I, Zone 1, Group IIB+H2, T5; Dust-Ignitionproof Class II, Division 1, Groups E, F, G; Class III Division 1; Intrinsically Safe Class I, Division 1 Groups A, B, C, D when connected in accordance with Rosemount drawing 03031-1024, Temperature Code T3C; Suitable for Class I, Zone 0; Class I Division 2 Groups A, B, C and D, T5; Suitable for Class I Zone 2, Group IIC; Type 4X; Factory Sealed; Single Seal (See drawing 03031-1053)

E6 Canada Explosionproof, Dust-Ignitionproof and Division 2
Certificate: 1053834
Standards: ANSI/ISA 12.27.01-2003, CSA Std. C22.2 No. 30 -M1986, CSA Std. C22.2 No.142-M1987, CSA Std. C22.2 No. 213 - M1987, CAN/CSA C22.2 No. 0-10, CSA Std C22.2 No. 25-1966, CAN/CSA-C22.2 No. 94-M91, CAN/CSA-C22.2 No. 157-92, CAN/CSA-E60079-0-07, CAN/CSA-E60079-1-07

Markings: Explosionproof Class I, Division 1, Groups B, C and D; Suitable for Class I, Zone 1, Group IIB+H2, T5; Dust-Ignitionproof for Class II and Class III, Division 1, Groups E, F and G; Class I, Division 2, Groups A, B, C and D; Suitable for Class I Zone 2, Group IIC; Type 4X; Factory Sealed; Single Seal (See drawing 03031-1053)

Europe

E8 ATEX Flameproof and Dust
Certificate: KEMA00ATEX2013X; Baseefa11ATEX0275X
Standards: EN60079-0:2012, EN60079-1:2014,EN60079-26:2015, EN60079-31:2009
Markings: ⟨Ex⟩II 1/2 G, Ex db IIC T6...T4 Ga/Gb, T6(–60 °C ≤ T_a ≤ +70 °C), T4/T5(–60 °C ≤ T_a ≤ +80 °C); ⟨Ex⟩II 1 D Ex T_a IIIC T95 °C T_{500} 105 °C Da (–20 °C ≤ T_a ≤ +85 °C)

Table 14. Process Temperature

Temperature class	Process temperature
T6	–60 °C to +70 °C
T5	–60 °C to +80 °C
T4	–60 °C to +120 °C

Special Conditions for Safe Use (X):

1. This device contains a thin wall diaphragm. Installation, maintenance and use shall take into account the environmental conditions to which the diaphragm will be subjected. The manufacturer's instructions for installation and maintenance shall be followed in detail to assure safety during its expected lifetime.
2. Flameproof joints are not intended for repair.
3. Non-standard point options may cause risk from electrostatic discharge. Avoid installations that could cause electrostatic build-up on painted surfaces, and only clean the painted surfaces with a damp cloth. If paint is ordered through a special option code, contact the manufacturer for more information.
4. Some variants of the equipment have reduced markings on the nameplate. Refer to the Certificate for full equipment marking.

I1 ATEX Intrinsic Safety and Dust
Certificate: BAS97ATEX1089X; Baseefa11ATEX0275X
Standards: EN60079-0:2012, EN60079-11:2012, EN60079-31:2009
Markings: HART: ⟨Ex⟩ II 1 G Ex ia IIC T5/T4 Ga T5(-60 °C ≤ T_a ≤ +40 °C), T4(-60 °C ≤ T_a ≤ +70 °C)
Fieldbus/PROFIBUS: ⟨Ex⟩ II 1 G Ex ia Ga IIC T4(-60°C ≤ T_a ≤ +60°C)
DUST: ⟨Ex⟩ II 1 D Ex T_a IIIC T95 °C T_{500}105 °C Da (-20 °C ≤ T_a ≤ +85 °C)

Table 15. Input Parameters

	HART	Fieldbus/PROFIBUS
Voltage U_i	30 V	30 V
Current I_i	200 mA	300 mA
Power P_i	0.9 W	1.3 W
Capacitance C_i	0.012 µF	0 µF
Inductance L_i	0 mH	0 mH

Special Conditions for Safe Use (X):

1. The apparatus is not capable of withstanding the 500 V insulation test required by clause 6.3.12 of EN60079-11:2012. This must be taken into account when installing the apparatus.
2. The enclosure may be made of aluminum alloy and given a protective polyurethane paint finish; however care should be taken to protect it from impact or abrasion if located in Zone 0.
3. Some variants of the equipment have reduced markings on the nameplate. Refer to the Certificate for full equipment marking.

IA ATEX FISCO
Certificate: BAS97ATEX1089X
Standards: EN60079-0:2012, EN60079-11:2009
Markings: ⟨Ex⟩ II 1 G Ex ia IIC Ga T4(-60 °C ≤ T_a ≤ +60 °C)

Table 16. Input Parameters

	FISCO
Voltage U_i	17.5 V
Current I_i	380 mA
Power P_i	5.32 W
Capacitance C_i	<5 nF
Inductance L_i	<10 µH

Special Conditions for Safe Use (X):

1. The apparatus is not capable of withstanding the 500 V insulation test required by clause 6.3.12 EN60079-11:2012. This must be taken into account when installing the apparatus.
2. The enclosure may be made of aluminum alloy and given a protective polyurethane paint finish; however care should be taken to protect it from impact or abrasion if located in Zone 0.

N1 ATEX Type n and Dust
Certificate: BAS00ATEX3105X; Baseefa11ATEX0275X
Standards: EN60079-0:2012, EN60079-15:2010, EN60079-31:2009
Markings: ⟨Ex⟩ II 3 G Ex nA IIC T5 Gc (–40 °C ≤ T_a ≤ +70 °C); ⟨Ex⟩ II 1 D Ex T_a IIIC T95 °C T_{500}105 °C Da (–20 °C ≤ T_a ≤ +85 °C)

Special Conditions for Safe Use (X):

1. This apparatus is not capable of withstanding the 500V insulation test that is required by clause 6.8.1 of EN60079-15. This must be taken into account when installing the apparatus.
2. Some variants of the equipment have reduced markings on the nameplate. Refer to the Certificate for full equipment marking.

International

E7 IECEx Flameproof and Dust
Certificate: IECEx KEM 09.0034X; IECEx BAS 10.0034X
Standards: IEC60079-0:2011, IEC60079-1:2014-06, IEC60079-26:2014-10, IEC60079-31:2008
Markings: Ex d IIC T6...T4 Ga/Gb, T6(–60 °C ≤ T_a ≤ +70 °C), T4/T5(–60 °C ≤ T_a ≤ +80 °C); Ex T_a IIIC T95 °C T_{500}105 °C Da (–20 °C ≤ T_a ≤ +85 °C)

Table 17. Process Temperature

Temperature class	Process temperature
T6	–60 °C to +70 °C
T5	–60 °C to +80 °C
T4	–60 °C to +120 °C

Special Conditions for Safe Use (X):

1. This device contains a thin wall diaphragm. Installation, maintenance and use shall take into account the environmental conditions to which the diaphragm will be subjected. The manufacturer's instructions for installation and maintenance shall be followed in detail to assure safety during its expected lifetime.
2. Flameproof joints are not intended for repair.
3. Non-standard point options may cause risk from electrostatic discharge. Avoid installations that could cause electrostatic build-up on painted surfaces, and only clean the painted surfaces with a damp cloth. If paint is ordered through a special option code, contact the manufacturer for more information.
4. Some variants of the equipment have reduced markings on the nameplate. Refer to the Certificate for full equipment marking.

I7 IECEx Intrinsic Safety
Certificate: IECEx BAS 09.0076X
Standards: IEC60079-0:2011, IEC60079-11:2011
Markings: HART: Ex ia IIC T5/T4 Ga, T5(–60 °C ≤ T_a ≤ +40 °C), T4(–60 °C ≤ T_a ≤ +70 °C)
Fieldbus/PROFIBUS: Ex ia IIC Ga T4(–60 °C ≤ T_a ≤ +60 °C)

Table 18. Input Parameters

	HART	Fieldbus/PROFIBUS
Voltage U_i	30 V	30 V
Current I_i	200 mA	300 mA
Power P_i	0.9 W	1.3 W
Capacitance C_i	0.012 µF	0 µF
Inductance L_i	0 mH	0 mH

Special Conditions for Safe Use (X):

1. If the apparatus is fitted with an optional 90 V transient suppressor, it is not capable of withstanding the 500 V insulation test required by clause 6.3.12 of IEC60079-11. This must be taken into account when installing the apparatus.
2. The enclosure may be made of aluminum alloy and given a protective polyurethane paint finish; however, care should be taken to protect it from impact or abrasion if located in Zone 0.

IECEx Mining (Special A0259)
Certificate: IECEx TSA 14.0001X
Standards: IEC60079-0:2011, IEC60079-11:2011
Markings: Ex ia I Ma (–60 °C ≤ T_a ≤ +70 °C)

Table 19. Input Parameters

	HART	Fieldbus/PROFIBUS	FISCO
Voltage U_i	30 V	30 V	17.5 V
Current I_i	200 mA	300 mA	380 mA
Power P_i	0.9 W	1.3 W	5.32 W
Capacitance C_i	0.012 µF	0 µF	<5 nF
Inductance L_i	0 mH	0 mH	<10 µH

Special Conditions for Safe Use (X):

1. If the apparatus is fitted with optional 90 V transient suppressor, it is not capable of withstanding the 500 V insulation test required by IEC60079-11. This must be taken into account when installing the apparatus.
2. It is a condition of safe use that the above input parameters shall be taken into account during installation.
3. It is a condition of manufacture that only the apparatus fitted with housing, covers and sensor module housing made out of stainless steel are used in Group I applications.

N7 IECEx Type n
Certificate: IECEx BAS 09.0077X
Standards: IEC60079-0:2011, IEC60079-15:2010
Markings: Ex nA IIC T5 Gc (–40 °C ≤ T_a ≤ +70 °C)

Special Condition for Safe Use (X):

1. The apparatus is not capable of withstanding the 500 V insulation test required by IEC60079-15. This must be taken into account when installing the apparatus.

Brazil

E2 INMETRO Flameproof
Certificate: UL-BR 13.0643X
Standards: ABNT NBR IEC60079-0:2008 + Errata 1:2011, ABNT NBR IEC60079-1:2009 + Errata 1:2011, ABNT NBR IEC60079-26:2008 + Errata 1:2008
Markings: Ex d IIC T6... T4 Ga/Gb, T6(–60 °C ≤ T_a ≤ +70 °C), T4/T5(–60 °C ≤ T_a ≤ +80 °C)

Special Conditions for Safe Use (X):

1. This device contains a thin wall diaphragm less than 1 mm thickness that forms a boundary between zone 0 (process connection) and zone 1 (all other parts of the equipment). The model code and data sheet are to be consulted for details of the diaphragm material. Installation, maintenance and use shall take into account the environmental conditions to which the diaphragm will be subjected. The manufacturer's instructions for installation and maintenance shall be followed in detail to assure safety during its expected lifetime.
2. Flameproof joints are not intended for repair.
3. Non-standard point options may cause risk from electrostatic discharge. Avoid installations that could cause electrostatic build-up on painted surfaces, and only clean the painted surfaces with a damp cloth. If paint is ordered through a special option code, contact the manufacturer for more information.

I2 INMETRO Intrinsic Safety
Certificate: UL-BR 13.0584X
Standards: ABNT NBR IEC60079-0:2008 + Errata 1:2011, ABNT NBR IEC60079-11:2009
Markings: HART: Ex ia IIC T5/T4 Ga, T5(–60 °C ≤ T_a ≤ +40 °C), T4(–60 °C ≤ T_a ≤ +70 °C)
Fieldbus/PROFIBUS: Ex ia IIC T4 Ga (–60 °C ≤ T_a ≤ +60 °C)

Table 20. Input Parameters

	HART	Fieldbus/PROFIBUS
Voltage U_i	30 V	30 V
Current I_i	200 mA	300 mA
Power P_i	0.9 W	1.3 W
Capacitance C_i	0.012 µF	0 µF
Inductance L_i	0 mH	0 mH

Special Conditions for Safe Use (X):

1. If the equipment is fitted with an optional 90 V transient suppressor, it is not capable of withstanding the 500 V insulation test required by ABNT NBR IRC 60079-11. This must be taken into account when installing the equipment.
2. The enclosure may be made of aluminum alloy and given a protective polyurethane paint finish; however, care should be taken to protect it from impact or abrasion if located in Zone 0.

IB INMETRO FISCO
Certificate: UL-BR 13.0584X
Standards: ABNT NBR IEC60079-0:2008 + Errata 1:2011, ABNT NBR IEC60079-11:2009
Markings: Ex ia IIC T4 Ga (–60 °C ≤ T_a ≤ +60 °C)

Table 21. Input Parameters

	FISCO
Voltage U_i	17.5 V
Current I_i	380 mA
Power P_i	5.32 W
Capacitance C_i	<5 nF
Inductance L_i	<10 µH

Special Conditions for Safe Use (X):

1. If the equipment is fitted with an optional 90 V transient suppressor, it is not capable of withstanding the 500 V insulation test required by ABNT NBR IEC 60079-11. This must be taken into account when installing the equipment.
2. The enclosure may be made of aluminum alloy and given a protective polyurethane paint finish; however, care should be taken to protect it from impact or abrasion if located in Zone 0.

China

E3 China Flameproof
Certificate: GYJ14.1041X; GYJ15.1368X [Flowmeters]
Standards: GB12476-2000; GB3836.1-2010, GB3836.2-2010, GB3836.20-2010
Markings: Ex d IIC T6/T5, T6(–50 °C ≤ T_a ≤ +65 °C), T5(–50 °C ≤ T_a ≤ +80 °C)

Special Conditions for Safe Use (X):

1. The relation between ambient temperature arrange and temperature class is as follows:

T_a	Temperature class
–50 °C~+80 °C	T5
–50 °C~+65 °C	T6

   When used in a combustible dust environment, the maximum ambient temperature is 80 °C.
2. The earth connection facility in the enclosure should be connected reliably.
3. Cable entry certified by notified body with type of protection Ex d IIC in accordance with GB3836.1-2000 and GB3836.2-2000, should be applied when installed in a hazardous location. When used in combustible dust environment, cable entry in accordance with IP66 or higher level should be applied.
4. Obey the warning “Keep tight when the circuit is alive.”

5. End users are not permitted to change any internal components.
6. During installation, use and maintenance of this product, observe the following standards: GB3836.13-1997, GB3836.15-2000, GB3836.16-2006, GB50257-1996, GB12476.2-2006, GB15577-2007

I3 China Intrinsic Safety
Certificate: GYJ13.1362X; GYJ15.1367X [Flowmeters]
Standards: GB3836.1-2010, GB3836.4–2010, GB3836.20-2010, GB12476.1-2000
Markings: Ex ia IIC Ga T4/T5

Special Conditions for Safe Use (X):

1. Symbol "X" is used to denote specific conditions of use:
   a. If the apparatus is fitted with an optional 90 V transient suppressor, it is not capable of withstanding the 500 V insulation test for 1 minute. This must be taken into account when installing the apparatus.
   b. The enclosure may be made of aluminum alloy and given a protective polyurethane paint finish; however, care should be taken to protect it from impact or abrasion if located in Zone 0.
2. The relation between T code and ambient temperature range is:

Model	T code	Temperature range
HART	T5	–60 °C ≤ T_a ≤ +40 °C
HART	T4	–60 °C ≤ T_a ≤ +70 °C
Fieldbus/PROFIBUS/ FISCO	T4	–40 °C ≤ T_a ≤ +60 °C

3. Intrinsically Safe parameters

Table 22. Input Parameters

	HART	Fieldbus/ PROFIBUS	FISCO
Voltage U_i	30 V	30 V	17.5 V
Current I_i	200 mA	300 mA	380 mA
Power P_i	0.9 W	1.3 W	5.32 W
Capacitance C_i	0.012 µF	0 µF	<5 nF
Inductance L_i	0 mH	0 mH	<10 µH

Note
FISCO parameters apply to both Group IIC and IIB.

[For Flowmeters] When Rosemount 644 Temperature Transmitter is used, it should be used with Ex-certified associated apparatus to establish explosion protection system that can be used in explosive gas atmospheres. Wiring and terminals should comply with the instruction manual of both Rosemount 644 Temperature Transmitter and associated apparatus. The cables between Rosemount 644 Temperatures Transmitter and associated apparatus should be shielded cables (the cables must have insulated shield). The shielded cable has to be grounded reliably in a non-hazardous area.

4. Transmitters comply with the requirements for FISCO field devices specified in IEC60079-27:2008. For the connection of an intrinsically safe circuit in accordance with FISCO Model, FISCO parameters are listed in the table above.
5. The product should be used with Ex-certified associated apparatus to establish explosion protection system that can be used in explosive gas atmospheres. Wiring and terminals should comply with the instruction manual of the product and associated apparatus.
6. The cables between this product and associated apparatus should be shielded cables (the cables must have insulated shield). The shielded cable has to be grounded reliably in a non-hazardous area.
7. End users are not permitted to change any intern components but to settle the problem in conjunction with the manufacturer to avoid damage to the product.
8. During installation, use and maintenance of this product, observe the following standards: GB3836.13-1997, GB3836.15-2000, GB3836.16-2006, GB50257-1996, GB12476.2-2006, GB15577-2007

N3 China Type n
Certificate: GYJ15.1105X
Standards: GB3836.1-2010, GB3836.8-2003
Markings: Ex nA nL IIC T5 Gc (–40 °C ≤ T_a ≤ +70 °C)

Special Condition for Safe Use (X):

1. Symbol "X" is used to denote specific conditions of use: The apparatus is not capable of withstanding the 500V test to earth for one minute. The must be taken into consideration during installation.

Japan

E4 Japan Flameproof
Certificate: TC20577, TC20578, TC20583, TC20584 [HART]; TC20579, TC20580, TC20581, TC20582 [Fieldbus]
Markings: Ex d IIC T5

Technical Regulations Customs Union (EAC)

EM EAC Flameproof
Certificate: RU C-US.GB05.B.01197
Markings: Ga/Gb Ex d IIC T5/T6 X, T5(–60 °C ≤ T_a ≤ +80 °C), T6(–60 °C ≤ T_a ≤ +65 °C)

Special Condition for Safe Use (X):

1. See certificate for special conditions.

IM EAC Intrinsically Safe
Certificate: RU C-US.GB05.B.01197
Markings: HART: 0Ex ia IIC T4/T5 Ga X,
T4(–60 °C ≤ T_a ≤ +70 °C),
T5(–60 °C ≤ T_a ≤ +40 °C)
Fieldbus/PROFIBUS: 0Ex ia IIC T4 Ga X
(–60 °C ≤ T_a ≤ +60 °C)

Special Condition for Safe Use (X):

1. See certificate for special conditions.

Combinations

K2 Combination of E2 and I2
K5 Combination of E5 and I5
K6 Combination of C6, E8, and I1
K7 Combination of E7, I7, and N7
K8 Combination of E8, I1, and N1
KB Combination of E5, I5, and C6
KD Combination of E8, I1, E5, I5, and C6
KM Combination of EM and IM

Conduit plugs and adapters

IECEx Flameproof and Increased Safety
Certificate: IECEx FMG 13.0032X
Standards: IEC60079-0:2011, IEC60079-1:2007, IEC60079-7:2006-2007
Markings: Ex de IIC Gb

ATEX Flameproof and Increased Safety
Certificate: FM13ATEX0076X
Standards: EN60079-0:2012, EN60079-1:2007, IEC60079-7:2007
Markings:  II 2 G Ex de IIC Gb

Table 23. Conduit Plug Thread Sizes

Thread	Identification mark
M20 × 1.5	M20
1/2 – 14 NPT	1/2 NPT

Table 24. Thread Adapter Thread Sizes

Male thread	Identification mark
M20 ×1.5 – 6H	M20
1/2 – 14 NPT	1/2 – 14 NPT
3/4 – 14 NPT	3/4 – 14 NPT
Female thread	**Identification mark**
M20 × 1.5 – 6H	M20
1/2 – 14 NPT	1/2 – 14 NPT
PG 1/2	PG 1/2

Special Conditions for Safe Use (X):

1. When the thread adapter or blanking plug is used with an enclosure in type of protection increased safety “e” the entry thread shall be suitably sealed in order to maintain the ingress protection rating (IP) of the enclosure.
2. The blanking plug shall not be used with an adapter.
3. Blanking Plug and Threaded Adapter shall be either NPT or Metric thread forms. G1/2 thread forms are only acceptable for existing (legacy) equipment installations.

Additional certifications

SBS American Bureau of Shipping (ABS) Type Approval
Certificate: 09-HS446883A-5-PDA
Intended Use: Marine & Offshore Applications - Measurement of either gauge or absolute pressure for liquid, gas and vapor.

SBV Bureau Veritas (BV) Type Approval
Certificate: 23155
Requirements: Bureau Veritas Rules for the Classification of Steel Ships
Application: Class notations: AUT-UMS, AUT-CCS, AUT-PORT and AUT-IMS; Pressure transmitter type 3051 cannot be installed on diesel engines

SDN Det Norske Veritas (DNV) Type Approval
Certificate: TAA000004F
Intended Use: DNV GL Rules for Classification – Ships and offshore units

Application:

Location classes	
Temperature	D
Humidity	B
Vibration	A
EMC	B
Enclosure	D

SLL Lloyds Register (LR) Type Approval
Certificate: 11/60002
Application: Environmental categories ENV1, ENV2, ENV3 and ENV5

C5 Custody Transfer - Measurement Canada Accuracy Approval
Certificate: AG-0226; AG-0454; AG-0477

IEC 62591 (*Wireless*HART Protocol)

Approved Manufacturing Locations

Rosemount Inc. — Chanhassen, Minnesota USA
Fisher-Rosemount GmbH and Co. — Wessling, Germany
Emerson Process Management Asia Pacific Private Limited — Singapore
Beijing Rosemount Far East Instrument Co., LTD — Beijing, China

European Directive Information

The most recent revision of the EC declaration of conformity can be found at Emerson.com/Rosemount.

Telecommunication Compliance

All wireless devices require certification to ensure that they adhere to regulations regarding the use of the RF spectrum. Nearly every country requires this type of product certification. Emerson is working with governmental agencies around the world to supply fully compliant products and remove the risk of violating country directives or laws governing wireless device usage.

FCC and IC

This device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions: This device may not cause harmful interference. This device must accept any interference received, including interference that may cause undesired operation. This device must be installed to ensure a minimum antenna separation distance of 20 cm from all persons.

Ordinary Location Certification for FM

As standard, the transmitter has been examined and tested to determine that the design meets basic electrical, mechanical, and fire protection requirements by FM, a nationally recognized testing laboratory (NRTL) as accredited by the Federal Occupational Safety and Health Administration (OSHA).

USA

I5 FM Intrinsically Safe
Certificate No: 3046325
Standards: Class 3600:2011, Class 3610:2010, Class 3810: 2005, Add: ANSI/ISA 60079-0 2009,ANSI/ISA 60079-11:2009 ANSI/NEMA 250:2003, ANSI/IEC 60529:2004
Markings: Intrinsically Safe for Class I, Division I, Groups A, B, C, D
Zone Marking: Class I Zone 0, AEx ia IIC T4 (–40 °C to 70 °C) Intrinsically Safe when installed according to Rosemount Drawing 03031-1062 Enclosure Type 4X/IP66/IP67/IP68

Special Conditions for Safe Use (X):

1. The In-Line pressure sensor may contain more than 10% aluminum and is considered a potential risk of ignition by impact or friction. Care must be taken into account during installation and use to prevent impact and friction.
2. The surface resistivity of the transmitter is greater than one gigaohm. To avoid electrostatic charge build-up, it must not be rubbed or cleaned with solvents or a dry cloth.
3. The Model 3051 Wireless Pressure Transmitter shall only be used with the 701PGNKF Rosemount SmartPower Battery Pack.

Canada

I6 CSA Intrinsically Safe
Certificate No: 2526009
Standards: CSA C22.2 No. 0-M91, CSA C22.2 No. 159-92, CSA C22.2 No. 94-M91, CSA C22.2 No. 142-M1987, CSA C22.2 No. 157-92, CSA C22.2 No. 60529-05
Markings: Intrinsically Safe For Class I, Division I, Groups A, B, C, D T4 (–40 °C to 70 °C) Intrinsically safe when installed according to Rosemount drawing 03031-1063 Enclosure Type 4X/IP66/IP68

European

I1 ATEX Intrinsic Safety
Certificate No: Baseefa12ATEX0228X
Standards: EN60079-11:2012, EN60079-0:2012
Markings: Ex ia IIC T4 Ga (–40 °C ≤ T_a ≤ 70 °C)
II 1G IP66/68 CE 1180

Special Conditions for Safe Use (X):

1. The plastic enclosure may constitute a potential electrostatic ignition risk and must not be rubbed or cleaned with a dry cloth.
2. The Model 701PGNKF Power Module may be replaced in a hazardous area. The Power Module has a surface resistivity greater than 1GΩ and must be properly installed in the wireless device enclosure. Care must be taken during transportation to and from the point of installation to prevent electrostatic charge build-up.

I7 IECEx Intrinsic Safety
Certificate: IECEx BAS 12.0124X
Standards: IEC60079-11:2011, IEC60079-0:2011
Markings: Ex ia IIC T4 Ga (–40 °C ≤ T_a ≤ 70 °C) IP66/68

Special Conditions for Safe Use (X):

1. The plastic enclosure may constitute a potential electrostatic ignition risk and must not be rubbed or cleaned with a dry cloth.
2. The Model 701PGNKF Power Module may be replaced in a hazardous area. The Power Module has a surface resistivity greater than 1GΩ and must be properly installed in the wireless device enclosure. Care must be taken during transportation to and from the point of installation to prevent electrostatic charge build-up.

Pipe I.D. range codes

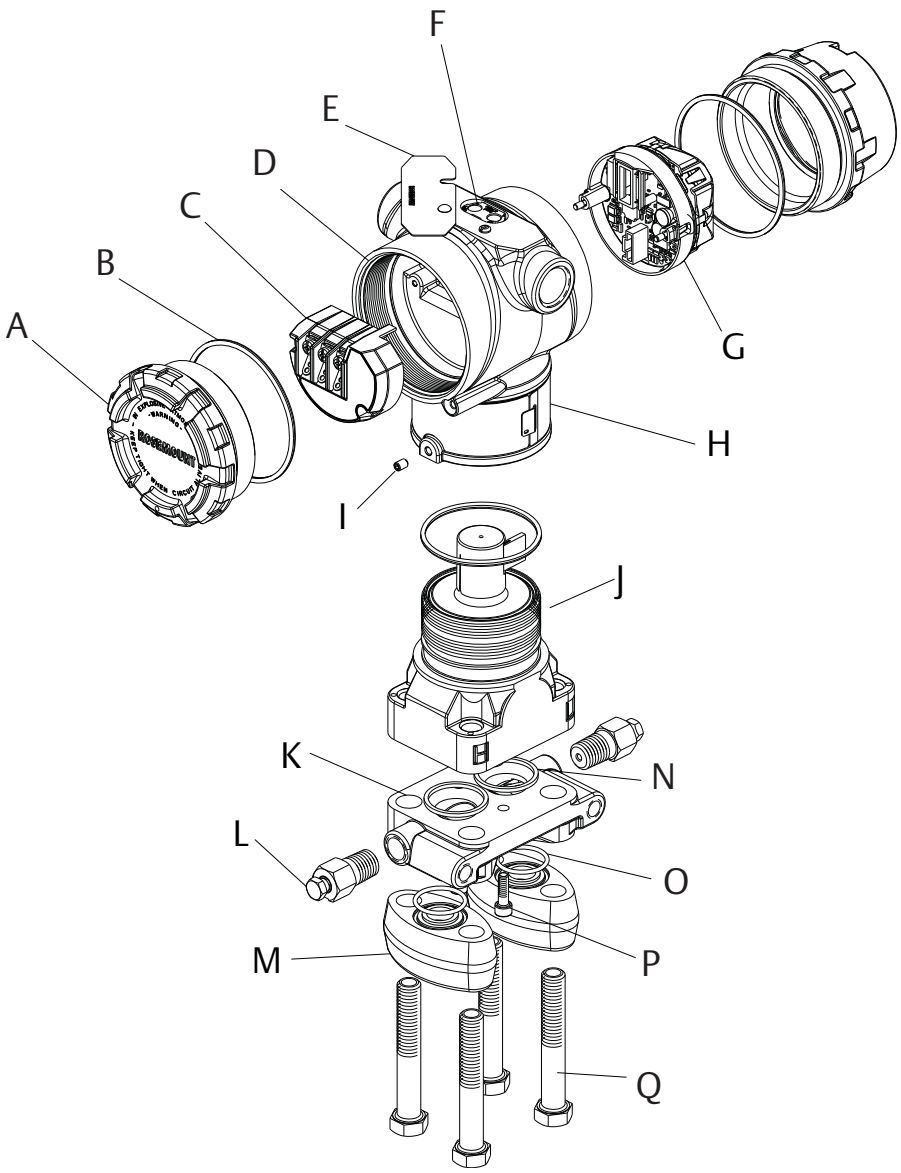
For pipes with an inner diameter (I.D.) range/pipe wall thickness not found in this table or with a line size greater than 12-in. (300 mm), choose option code Z and specify the exact pipe dimensions (I.D. and pipe wall thickness) on the Configuration Data Sheet. The Emerson sizing program will determine this code, based on the application piping.

	Line size			I.D. range	Pipe wall thickness		I.D. range code
	Nominal	Max. O.D.	Option code		ANSI pipes	Non-ANSI pipes	
N/A	2-in. (50 mm)	2.625-in. (66.68 mm)	020	1.784 to 1.841-in. (45.31 to 46.76 mm)	0.065 to 0.545-in. (1.7 to 13.8 mm)	0.065 to 0.488-in. (1.7 to 12.4 mm)	A
				1.842 to 1.938-in. (46.79 to 49.23 mm)		0.065 to 0.449-in. (1.7 to 11.4 mm)	B
				1.939 to 2.067-in. (49.25 to 52.50 mm)		0.065 to 0.417-in. (1.7 to 10.6 mm)	C
				2.068 to 2.206-in. (52.53 to 56.03 mm)		0.065 to 0.407-in. (1.7 to 10.3 mm)	D
	2 1/2-in. (63.5 mm)	3.188-in. (80.98 mm)	025	2.207 to 2.322-in. (56.06 to 58.98 mm)	0.083 to 0.563-in. (2.1 to 14.3 mm)	0.083 to 0.448-in. (2.1 to 11.4 mm)	B
				2.323 to 2.469-in. (59.00 to 62.71 mm)		0.083 to 0.417-in. (2.1 to 10.6 mm)	C
				2.470 to 2.598-in. (62.74 to 65.99 mm)		0.083 to 0.435-in. (2.1 to 11.0 mm)	D
				2.599 to 2.647-in. (66.01 to 67.23 mm)		0.083 to 0.515-in. (2.1 to 13.1 mm)	E
	3-in. (80 mm)	3.75-in. (95.25 mm)	030	2.648 to 2.751-in. (67.26 to 69.88 mm)	0.083 to 0.563-in. (2.1 to 14.3 mm)	0.083 to 0.460-in. (2.1 to 11.7 mm)	A
				2.752 to 2.899-in. (69.90 to 73.63 mm)		0.083 to 0.416-in. (2.1 to 10.6 mm)	B
				2.900 to 3.068-in. (73.66 to 77.93 mm)		0.083 to 0.395-in. (2.1 to 10.0 mm)	C
				3.069 to 3.228-in. (77.95 to 81.99 mm)		0.083 to 0.404-in (2.1 to 10.3 mm)	D
	3 1/2-in. (89 mm)	4.25-in. (107.95 mm)	035	3.229 to 3.333-in. (82.02 to 84.66 mm)	0.120 to 0.600-in. (3.0 to 15.2 mm)	0.120 to 0.496-in. (3.0 to 12.6 mm)	B
				3.334 to 3.548-in. (84.68 to 90.12 mm)		0.120 to 0.386-in. (3.0 to 9.8 mm)	C
				3.549 to 3.734-in. (90.14 to 94.84 mm)		0.120 to 0.415-in. (3.0 to 10.5 mm)	D
	4-in. (100 mm)	5.032-in. (127.81 mm)	040	3.735 to 3.825-in. (94.87 to 97.16 mm)	0.120 to 0.600-in. (3.0 to 15.2 mm)	0.120 to 0.510-in. (3.0 to 13.0 mm)	B
				3.826 to 4.026-in. (97.18 to 102.26 mm)		0.120 to 0.400-in. (3.0 to 10.2 mm)	C
				4.027 to 4.237-in. (102.29 to 107.62 mm)		0.120 to 0.390-in. (3.0 to 9.9 mm)	D
				4.238 to 4.437-in. (107.65 to 112.70 mm)		0.120 to 0.401-in. (3.0 to 10.2 mm)	E
	5-in. (125 mm)	6.094-in. (154.79 mm)	050	4.438 to 4.571-in. (112.73 to 116.10 mm)	0.134 to 0.614-in. (3.4 to 15.6 mm)	0.134 to 0.481-in. (3.4 to 12.2 mm)	A
				4.572 to 4.812-in. (116.13 to 122.22 mm)		0.134 to 0.374-in. (3.4 to 9.5 mm)	B
				4.813 to 5.047-in. (122.25 to 128.19 mm)		0.134 to 0.380-in. (3.4 to 9.7 mm)	C
				5.048 to 5.249-in. (128.22 to 133.32 mm)		0.134 to 0.413-in. (3.4 to 10.5 mm)	D
Sensor size 1	6-in. (150 mm)	6.93-in. (176.02 mm)	060	5.250 to 5.472-in. (133.35 to 138.99 mm)	0.134 to 0.614-in. (3.4 to 15.6 mm)	0.134 to 0.3919-in. (3.4 to 9.9 mm)	A
				5.473 to 5.760-in. (139.01 to 146.30 mm)		0.134 to 0.327-in. (3.4 to 8.3 mm)	B
				5.761 to 6.065-in. (146.33 to 154.05 mm)		0.134 to 0.31-in. (3.4 to 7.9 mm)	C
				6.066 to 6.383-in. (154.08 to 162.13 mm)		0.134 to 0.297-in. (3.4 to 7.5 mm)	D

Sensor size 2	6-in. (150 mm)	6.93-in. (176.02 mm)	060	5.250 to 5.472-in. (133.35 to 139.99 mm)	0.134 to 1.354-in. (3.4 to 34.4 mm)	0.134 to 1.132-in. (3.4 to 28.7 mm)	A
				5.473 to 5.760-in. (139.01 to 146.30 mm)		0.134 to 1.067-in. (3.4 to 27.1 mm)	B
				5.761 to 6.065-in. (146.33 to 154.05 mm)		0.134 to 1.05-in. (3.4 to 26.7 mm)	C
				6.066 to 6.383-in. (154.08 to 162.13 mm)		0.134 to 1.037-in. (3.4 to 26.3 mm)	D
Sensor size 1	7-in. (180 mm)	7.93-in. (201.42 mm)	070	6.384 to 6.624-in. (162.15 to 168.25 mm)	0.134 to 0.614-in. (3.4 to 15.6 mm)	0.134 to 0.374-in. (3.4 to 9.5 mm)	B
				6.625 to 7.023-in. (168.28 to 178.38 mm)		0.134 to 0.216-in. (3.4 to 5.5 mm)	C
				7.024 to 7.392-in. (178.41 to 187.76 mm)		0.134 to 0.246-in. (3.4 to 6.2 mm)	D
Sensor size2	7-in. (180 mm)	7.93-in. (201.42 mm)	070	6.384 to 6.624-in. (162.15 to 168.25 mm)	0.134 to 1.354-in. (3.4 to 34.4 mm)	0.134 to 1.114-in. (3.4 to 28.3 mm)	B
				6.625 to 7.023-in. (168.28 to 178.38 mm)		0.134 to 0.956-in. (3.4 to 24.3 mm)	C
				7.024 to 7.392-in. (178.41 to 187.76 mm)		0.134 to 0.986-in. (3.4 to 25.0 mm)	D
Sensor size 1	8-in. (200 mm)	9.688-in. (246.08 mm)	080	7.393 to 7.624-in. (187.78 to 193.65 mm)	0.250 to 0.73-in. (6.4 to 18.5 mm)	0.250 to 0.499-in. (6.4 to 12.6 mm)	B
				7.625 to 7.981-in. (193.68 to 202.72 mm)		0.250 to 0.374-in. (6.4 to 9.5 mm)	C
				7.982 to 8.400-in. (202.74 to 213.36 mm)		0.250 to 0.312-in. (6.4 to 7.9 mm)	D
				8.401 to 8.766-in. (213.39 to 222.66 mm)		0.250 to 0.364-in. (6.4 to 9.2 mm)	E
Sensor size 2	8-in. (200 mm)	9.688-in. (246.08 mm)	080	7.393 to 7.624-in. (187.78 to 193.65 mm)	0.250 to 1.47-in. (6.4 to 37.3 mm)	0.250 to 1.239-in. (6.4 to 31.4 mm)	B
				7.625 to 7.981-in. (193.68 to 202.72 mm)		0.250 to 1.114-in. (6.4 to 28.3 mm)	C
				7.982 to 8.400-in. (202.74 to 213.36 mm)		0.250 to 1.052-in. (6.4 to 26.7 mm)	D
				8.401 to 8.766-in. (213.39 to 222.66 mm)		0.250 to 1.104-in. (6.4 to 28.0 mm)	E
N/A	10-in. (250 mm)	11.75-in. (298.45 mm)	100	8.767 to 9.172-in. (222.68 to 232.97 mm)	0.250 to 1.470-in. (6.4 to 37.3 mm)	0.250 to 1.065-in. (6.4 to 27.1 mm)	A
				9.173 to 9.561-in. (232.99 to 242.85 mm)		0.250 to 1.082-in. (6.4 to 27.5 mm)	B
				9.562 to 10.020-in. (242.87 to 254.51 mm)		0.250 to 1.012-in. (6.4 to 25.7 mm)	C
				10.021 to 10.546-in. (254.53 to 267.87 mm)		0.250 to 0.945-in. (6.4 to 24.0 mm)	D
				10.547 to 10.999-in. (267.89 to 279.37 mm)		0.250 to 1.018-in. (6.4 to 25.9 mm)	E
	12-in. (300 mm)	13.0375-in. (331.15 mm)	120	11.000 to 11.373-in. (279.40 to 288.87 mm)	0.250 to 1.470-in. (6.4 to 37.3 mm)	0.250 to 1.097-in. (6.4 to 27.9 mm)	B
				11.374 to 11.938-in. (288.90 to 303.23 mm)		0.250 to 0.906-in. (6.4 to 23.0 mm)	C
				11.939 to 12.250-in. (303.25 to 311.15 mm)		0.250 to 1.159-in. (6.4 to 29.4 mm)	D

Dimensional drawings[1]

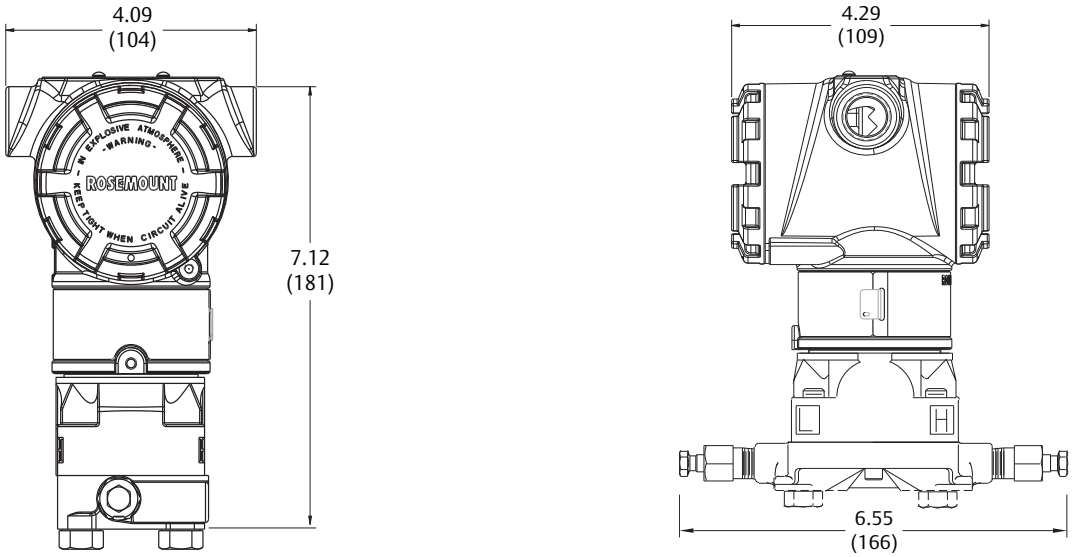
Figure 1. Rosemount 3051C Exploded View



A. Cover
B. Cover O-ring
C. Terminal block
D. Electronics housing
E. Configuration buttons cover
F. Local configuration buttons
G. Electronics board
H. Name plate
I. Housing rotation set screw (180 degree maximum rotation without further disassembly)
J. Sensor module
K. Coplanar flange
L. Drain/vent valve
M. Flange adapters
N. Process O-ring
O. Flange adapter O-ring
P. Flange alignment screw (not pressure retaining)
Q. Flange bolts

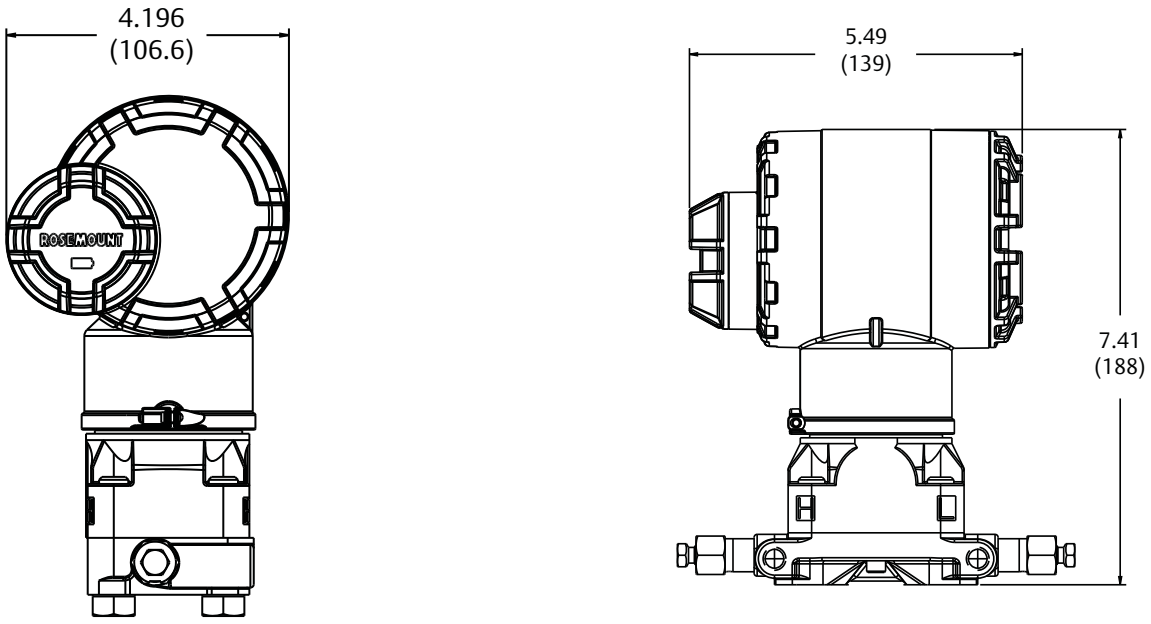
1. *This section contains dimensional drawings for output codes A, F and X. For output codes W and M, visit Emerson.com/Rosemount/Documentation-and-Drawings*

Figure 2. Rosemount 3051C Coplanar Flange



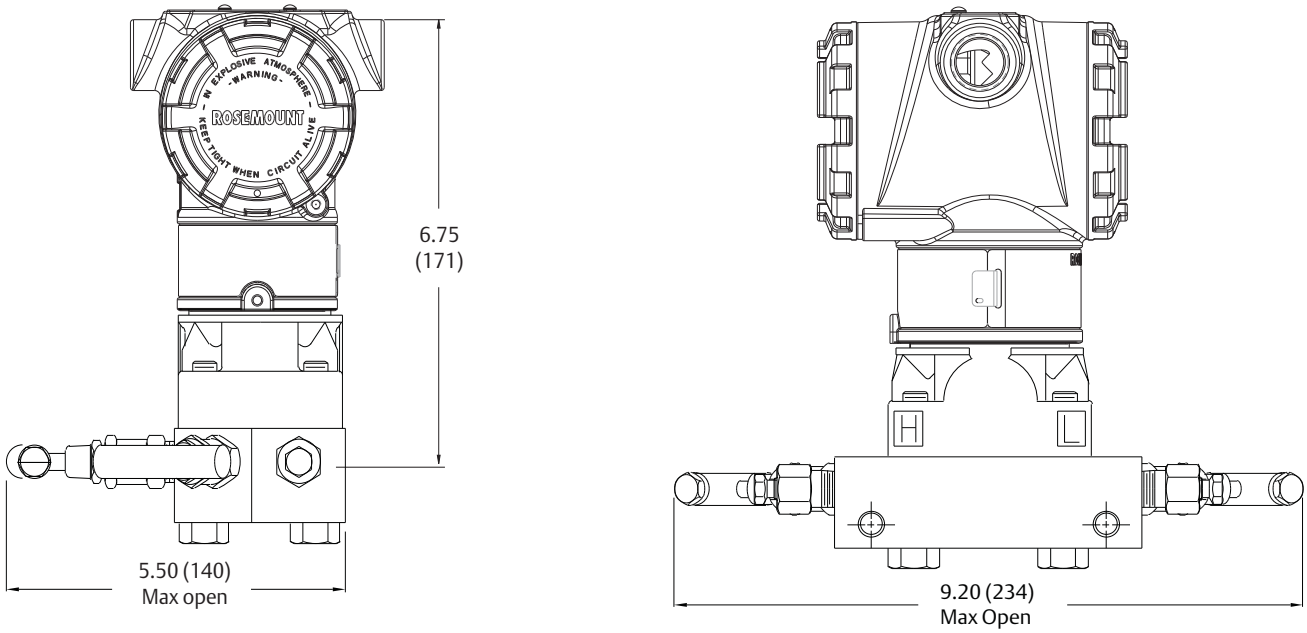
Dimensions are in inches (millimeters).

Figure 3. Rosemount 3051 Wireless Housing with Coplanar Flange



Dimensions are in inches (millimeters).

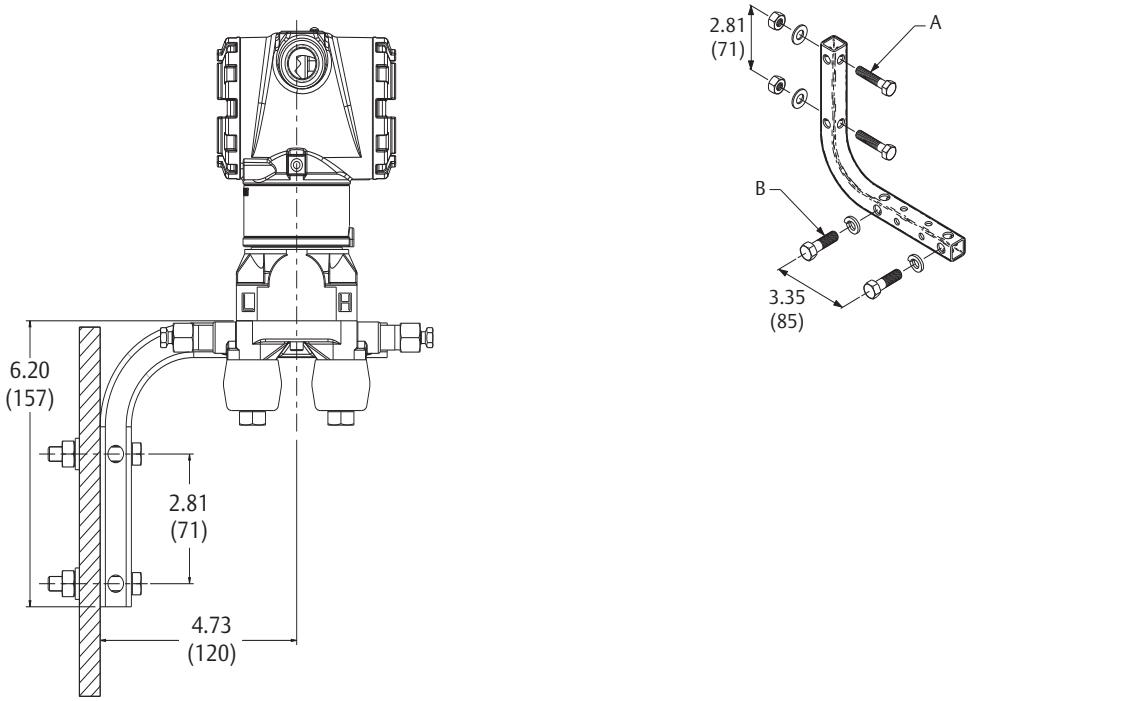
Figure 4. Rosemount 3051C Coplanar Flange with Rosemount 305RC3 3-Valve Coplanar Integral Manifold



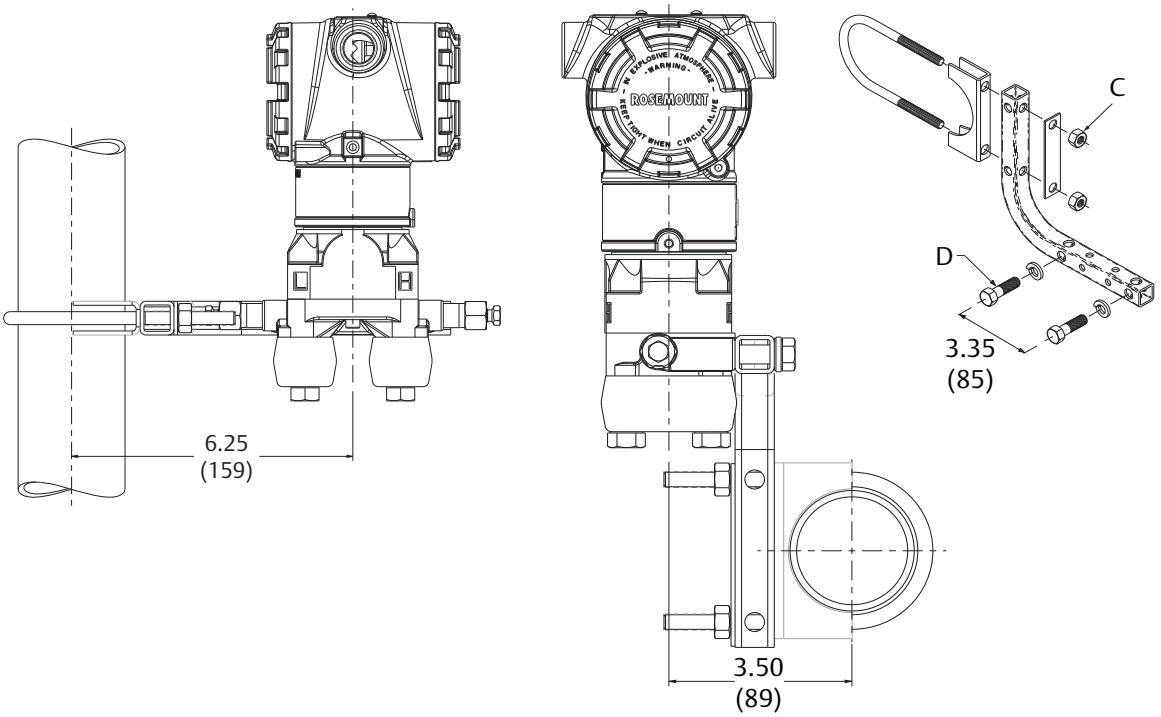
Dimensions are in inches (millimeters).

Figure 5. Coplanar Flange Mounting Configurations with Optional Bracket (B4) for 2-in. Pipe or Panel Mounting

Panel mounting



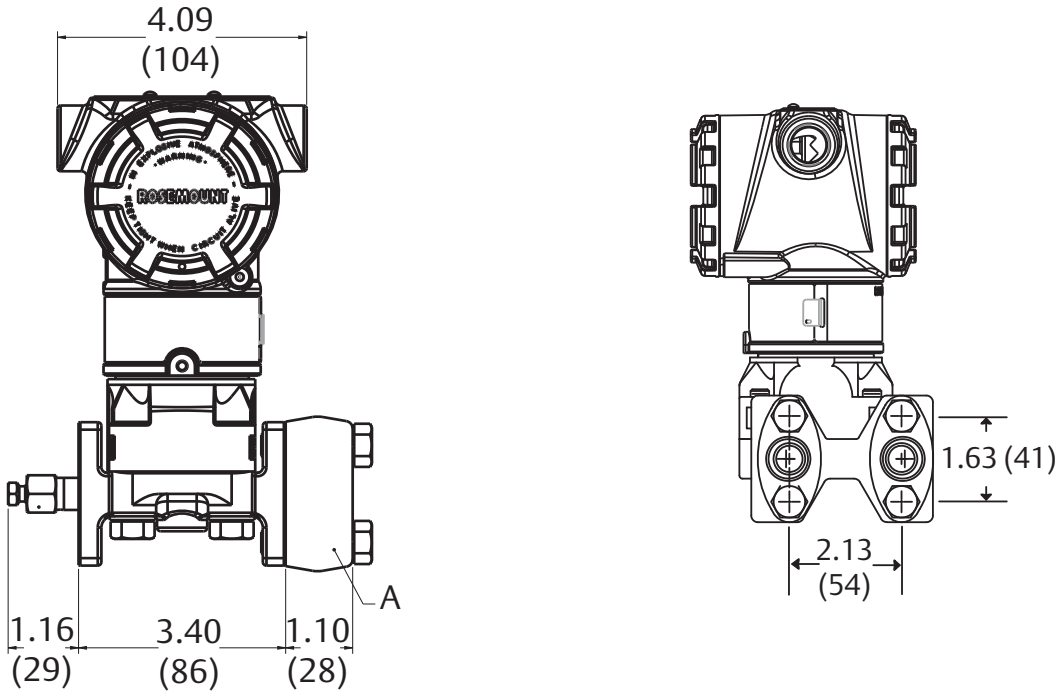
Pipe mounting



A. 5/16–18 bolts (not supplied)
B. 3/8–16 bolts
Dimensions are in inches (millimeters).

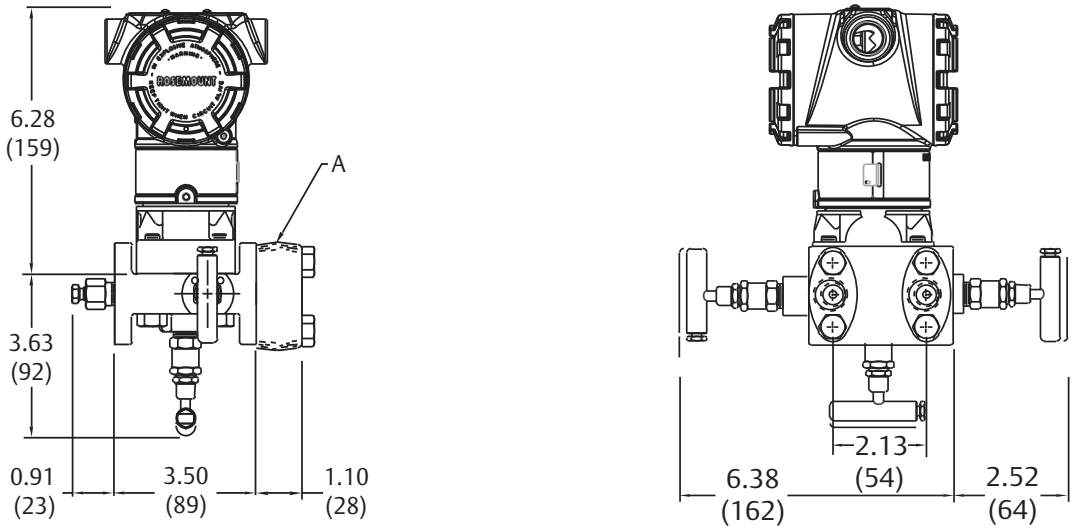
C. 2-in. U-bolt
D. 3/8–16 bolts

Figure 6. Rosemount 3051C Coplanar with Traditional Flange



A. Flange adapters (optional)
Dimensions are in inches (millimeters).

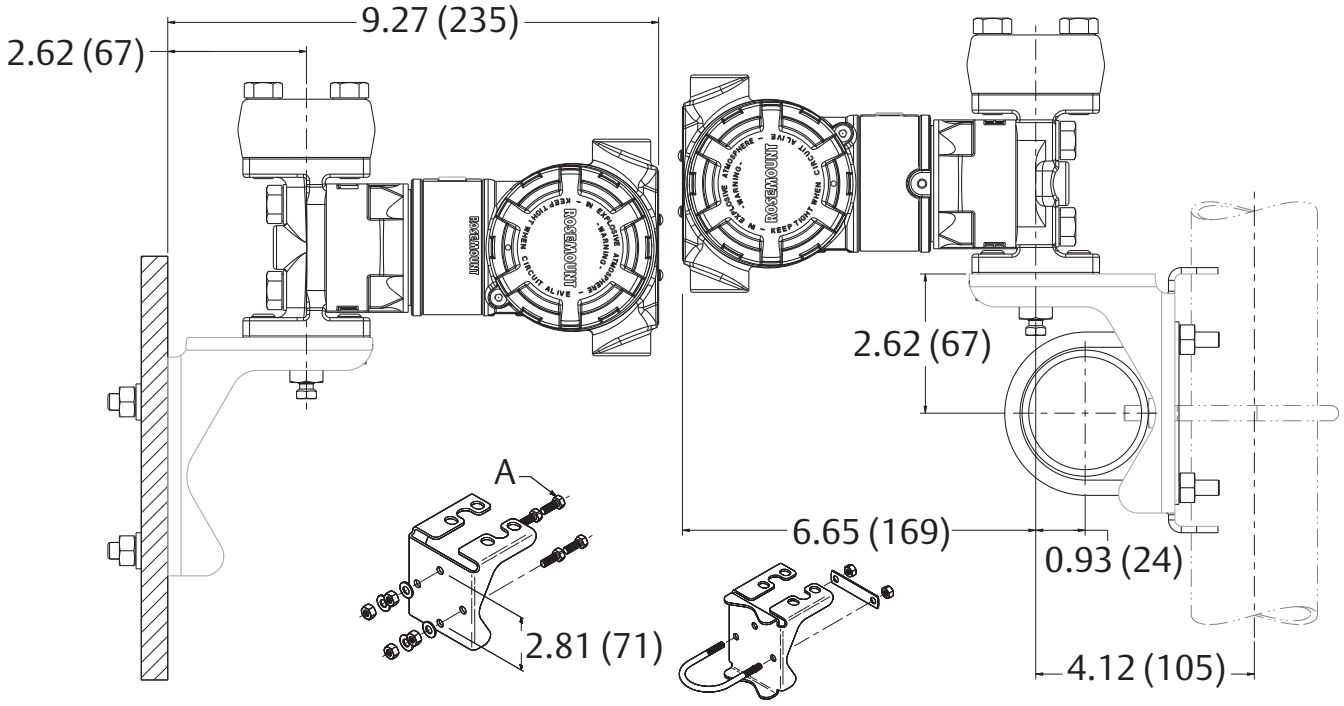
Figure 7. Rosemount 3051C Coplanar with Rosemount 305RT3 3-Valve Traditional Integral Manifold



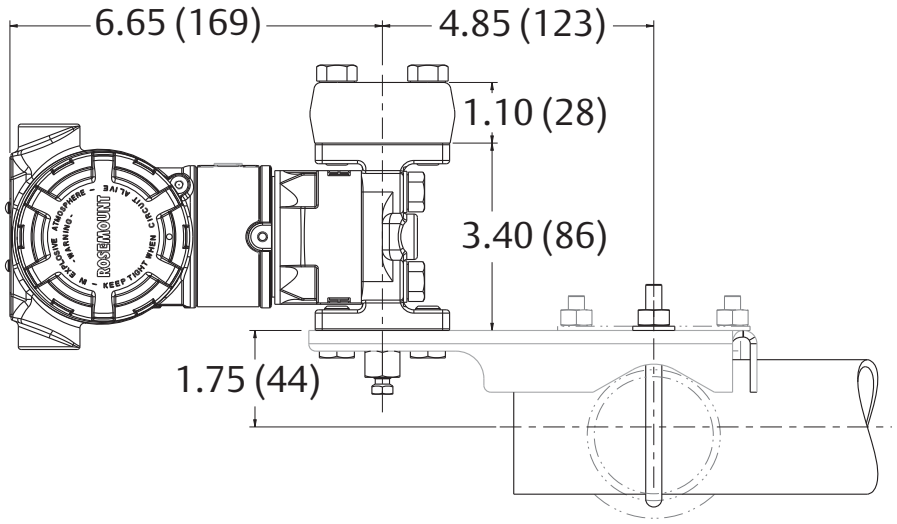
A. 1/2–14 NPT flange adapter (optional)
Dimensions are in inches (millimeters).

Figure 8. Traditional Flange Mounting Configurations with Optional Brackets for 2-in. Pipe or Panel Mounting

Panel mounting bracket (option B2/B8) **Pipe mounting bracket (option B1/B7/BA)**



Pipe mounting bracket (option B3/B9/BC)



A. 5/16-18 bolts (not supplied)
Dimensions are in inches (millimeters).

Table 26. Rosemount 3051L Dimensional Specifications

Class[1]	Pipe size	Flange thickness A	Bolt circle diameter H	Outside diameter J	No. of bolts	Bolt hole diameter	Extension diameter[1] D	O.D. gasket surface E
ASME B16.5 (ANSI) 150	2 (51)	0.69 (18)	4.75 (121)	6.0 (152)	4	0.75 (19)	N/A	3.6 (92)
	3 (76)	0.88 (22)	6.0 (152)	7.5 (191)	4	0.75 (19)	2.58 (66)	5.0 (127)
	4 (102)	0.88 (22)	7.5 (191)	9.0 (229)	8	0.75 (19)	3.5 (89)	6.2 (158)
ASME B16.5 (ANSI) 300	2 (51)	0.82 (21)	5.0 (127)	6.5 (165)	8	0.75 (19)	N/A	3.6 (92)
	3 (76)	1.06 (27)	6.62 (168)	8.25 (210)	8	0.88 (22)	2.58 (66)	5.0 (127)
	4 (102)	1.19 (30)	7.88 (200)	10.0 (254)	8	0.88 (22)	3.5 (89)	6.2 (158)
ASME B16.5 (ANSI) 600	2 (51)	1.00 (25)	5.0 (127)	6.5 (165)	8	0.75 (19)	N/A	3.6 (92)
	3 (76)	1.25 (32)	6.62 (168)	8.25 (210)	8	0.88 (22)	2.58 (66)	5.0 (127)
DIN 2501 PN 10–40	DN 50	20 mm	125 mm	165 mm	4	18 mm	N/A	4.0 (102)
DIN 2501 PN 25/40	DN 80	24 mm	160 mm	200 mm	8	18 mm	66 mm	5.4 (138)
	DN 100	24 mm	190 mm	235 mm	8	22 mm	89 mm	6.2 (158)
DIN 2501 PN 10/16	DN 100	20 mm	180 mm	220 mm	8	18 mm	89 mm	6.2 (158)

Dimensions are in inches (millimeters).

1. Tolerances are 0.040 (1.02), - 0.020 (0.51).

Class[1]	Pipe size	Process side G	Lower housing F		C
			1/4-in. NPT	1/2 -in. NPT	
ASME B16.5 (ANSI) 150	2 (51)	2.12 (54)	0.97 (25)	1.31 (33)	5.65 (143)
	3 (76)	3.60 (91)	0.97 (25)	1.31 (33)	5.65 (143)
	4 (102)	3.60 (91)	0.97 (25)	1.31 (33)	5.65 (143)
ASME B16.5 (ANSI) 300	2 (51)	2.12 (54)	0.97 (25)	1.31 (33)	5.65 (143)
	3 (76)	3.60 (91)	0.97 (25)	1.31 (33)	5.65 (143)
	4 (102)	3.60 (91)	0.97 (25)	1.31 (33)	5.65 (143)
ASME B16.5 (ANSI) 600	2 (51)	2.12 (54)	0.97 (25)	1.31 (33)	7.65 (194)
	3 (76)	3.60 (91)	0.97 (25)	1.31 (33)	7.65 (194)
DIN 2501 PN 10–40	DN 50	2.40 (61)	0.97 (25)	1.31 (33)	5.65 (143)
DIN 2501 PN 25/40	DN 80	3.60 (91)	0.97 (25)	1.31 (33)	5.65 (143)
	DN 100	3.60 (91)	0.97 (25)	1.31 (33)	5.65 (143)
DIN 2501 PN 10/16	DN 100	3.60 (91)	0.97 (25)	1.31 (33)	5.65 (143)

1. Tolerances are 0.040 (1.02), - 0.020 (0.51).

Options

Standard configuration

Unless otherwise specified, transmitter is shipped as follows:

ENGINEERING UNITS Differential/Gage: Absolute/ Rosemount 3051TA/ Rosemount 3051TG:	inH_2O (Range 0, 1, 2, and 3) psi (all ranges)
4 mA[1]:	0 (engineering units above)
20 mA[1]:	Upper range limit
Output:	Linear
External buttons:	None
Flange type:	Specified model code option
Flange material:	Specified model code option
O-ring material:	Specified model code option
Drain/vent:	Specified model code option
LCD Display:	None
Alarm[1]:	High
Software tag:	(Blank)
Damping:	0.4 seconds[2]

1. Not applicable to FOUNDATION Fieldbus, PROFIBUS PA, or wireless.
2. For Fieldbus protocols, default damping is 1 second.

Custom configuration[1]

If option code C1 is ordered, the customer may specify the following data in addition to the standard configuration parameters.

- Output information
- Transmitter information
- LCD display configuration
- Hardware selectable information
- Signal selection
- Wireless information
- Scaled variable

Refer to the Rosemount 3051 Configuration Data Sheet for Rosemount 3051 HART protocol.

For Wireless, refer to the Rosemount 3051 Wireless Configuration Data Sheet.[1]

Tagging (three options available)

- Standard SST hardware tag is wired to the transmitter. Tag character height is 0.125-in. (3,18 mm), 56 characters maximum.
- Tag may be permanently stamped on transmitter nameplate upon request, 56 characters maximum.
- Tag may be stored in transmitter memory. Character limit is dependent on protocol.
  - HART Revision 5: 8 characters
  - HART Revision 7 and Wireless: 32 characters
  - FOUNDATION Fieldbus: 32 characters
  - PROFIBUS PA: 32 characters

Commissioning tag[2]

A temporary commissioning tag is attached to all transmitters. The tag indicates the device ID and allows an area for writing the location.

Optional Rosemount 304, 305 or 306 Integral Manifolds

Factory assembled to 3051C and 3051T transmitters. Refer to the following Product Data Sheet for Rosemount 304, 305, and 306 for additional information.

Other seals

Refer to Rosemount DP Level Transmitters and 1199 Diaphragm Seal System Product Data Sheet for additional information.

1. *Not applicable to FOUNDATION Fieldbus or PROFIBUS PA protocols.*
2. *Only applicable to FOUNDATION Fieldbus.*

Output information

Output range points must be the same unit of measure. Available units of measure include:

Pressure			
atm	inH_2O@4 °C[2]	g/cm^2	psi
mbar	mmH_2O	kg/cm^2	torr
bar	mmHg	Pa	cmH_2O @4 °C[1][2]
inH_20	mmH_2O @4 °C[2]	kPa	mH_2O @4 °C[1][2]
inHg	ftH_20	MPa[2]	ftH_2O @60 °F[1][2]
hPa[1][2]	inH_2O@60 °F[2]	kg/m^2[1][2]	cmHg @0 °C[1][2]
mHg @0 °C[1][2]	psf[1][2]	ftH_2O @4 °C[1][2]	

1. Field configurable only, not available for factory calibration or custom configuration (option code C1 "Software configuration").
2. Not available with Low Power (output code M) or PROFIBUS PA (output option code W).

Display and interface options

M4 Digital display with LOI
- Available for 4–20 mA HART and PROFIBUS PA

M5 Digital display
- 2-Line, 5-Digit LCD display for low power output
- 2-Line, 8-Digit LCD display for 4–20 mA HART, FOUNDATION Fieldbus and PROFIBUS PA
- 3-Line, 7-digit LCD display for Wireless
- Direct reading of digital data for higher accuracy
- Displays user-defined flow, level, volume, or pressure units
- Displays diagnostic messages for local troubleshooting
- 90-degree rotation capability for easy viewing

Configuration buttons

Rosemount 3051 will ship with no buttons unless option D4 (analog zero and span), DZ (digital zero), or M4 (LOI) for local configuration buttons are specified.
The Rosemount 3051 Wireless Transmitter is available with a Digital zero button installed with or without the LCD display digital display.

Transient protection (option code T1)

Tested in accordance with IEEE C62.41.2-2002, location category B
6 kV crest (0.5 µs–100 kHz)
3 kA crest (8 × 20 µs)
6 kV crest (1.2 × 50 µs)

Bolts for flanges and adapters

- Options permit bolts for flanges and adapters to be obtained in various materials
- Standard material is plated carbon steel per ASTM A449, Type 1
  - L4 austenitic 316 stainless steel bolts
  - L5 ASTM A 193, Grade B7M bolts
  - L6 alloy k-500 bolts

Conduit plug

DO 316 SST conduit plug
Single 316 SST conduit plug replaces carbon steel plug

Rosemount 3051C Coplanar Flange and 3051T bracket option

B4 Bracket for 2-in. pipe or panel mounting
- For use with the standard coplanar flange configuration
- Bracket for mounting of transmitter on 2-in. pipe or panel
- Stainless steel construction with stainless steel bolts

Rosemount 3051C Traditional Flange bracket options

B1 Bracket for 2-in. pipe mounting
- For use with the traditional flange option
- Bracket for mounting on 2-in. pipe
- Carbon steel construction with carbon steel bolts
- Coated with polyurethane paint

B2 Bracket for panel mounting
- For use with the traditional flange option
- Bracket for mounting transmitter on wall or panel
- Carbon steel construction with carbon steel bolts
- Coated with polyurethane paint

B3 Flat Bracket for 2-in. pipe mounting
- For use with the traditional flange option
- Bracket for vertical mounting of transmitter on 2-in. pipe
- Carbon steel construction with carbon steel bolts
- Coated with polyurethane paint

B7 B1 Bracket with SST bolts
- Same bracket as the B1 option with Series 300 stainless steel bolts

B8 B2 Bracket with SST bolts
- Same bracket as the B2 option with Series 300 stainless steel bolts

B9 B3 Bracket with SST bolts
- Same bracket as the B3 option with Series 300 stainless steel bolts

BA Stainless steel B1 bracket with SST bolts
- B1 bracket in stainless steel with Series 300 stainless steel bolts

BC Stainless Steel B3 Bracket with SST bolts
- B3 bracket in stainless steel with Series 300 stainless steel bolts

Global Headquarters

Emerson Automation Solutions
6021 Innovation Blvd.
Shakopee, MN 55379, USA
+1 800 999 9307 or +1 952 906 8888
+1 952 949 7001
RFQ.RMD-RCC@Emerson.com

North America Regional Office

Emerson Automation Solutions
8200 Market Blvd.
Chanhassen, MN 55317, USA
+1 800 999 9307 or +1 952 906 8888
+1 952 949 7001
RMT-NA.RCCRFQ@Emerson.com

Latin America Regional Office

Emerson Automation Solutions
1300 Concord Terrace, Suite 400
Sunrise, FL 33323, USA
+1 954 846 5030
+1 954 846 5121
RFQ.RMD-RCC@Emerson.com

Europe Regional Office

Emerson Automation Solutions Europe GmbH
Neuhofstrasse 19a P.O. Box 1046
CH 6340 Baar
Switzerland
+41 (0) 41 768 6111
+41 (0) 41 768 6300
RFQ.RMD-RCC@Emerson.com

Asia Pacific Regional Office

Emerson Automation Solutions Asia Pacific Pte Ltd
1 Pandan Crescent
Singapore 128461
+65 6777 8211
+65 6777 0947
Enquiries@AP.Emerson.com

Middle East and Africa Regional Office

Emerson Automation Solutions
Emerson FZE P.O. Box 17033
Jebel Ali Free Zone - South 2
Dubai, United Arab Emirates
+971 4 8118100
+971 4 8865465
RFQ.RMTMEA@Emerson.com

Linkedin.com/company/Emerson-Automation-Solutions

Twitter.com/Rosemount_News

Facebook.com/Rosemount

Youtube.com/user/RosemountMeasurement

Google.com/+RosemountMeasurement

Rosemount 1199 Remote Mount Seal Systems

Tuned-System Assembly Comprised of Rosemount 1199 Direct Mount Seal combined with Rosemount 1199 Remote Mount Seal

Rosemount 1199 Remote Mount Seals are used commonly at the top of the vessel when a DP measurement is required. The capillary that is used is available in three different diameters to optimize time response and reduce temperature effects.

Product features and capabilities include:

- Remote Mount Seals can be used for high temperature applications.
- Remote Mount Seals are used on the low pressure side of the transmitter for Tuned-System Assemblies that can be used for DP measurements in closed or pressurized tank applications.
- Variety of process connections.
- Quantified performance for the entire transmitter/seal assembly (QZ option).

Additional Information:

Specifications: page 125
Certifications: page 156
Dimensional Drawings: page 166

Specification and selection of product materials, options, or components must be made by the purchaser of the equipment. See page 139 for more information on material selection.

Rosemount 1199 Remote Mount Seal

The Rosemount 1199 Remote Mount Seal also requires specification of a Rosemount pressure transmitter. See the appropriate product data sheet for the desired transmitter and include the option indicated in the table below for the configuration desired.

When ordering Rosemount 1199 Direct and Remote Mount Seals, make sure to add the correct seal system ordering code to the transmitter or gage model.

Table 17. Direct Mount Seal Attach To Code Per Transmitter or Gage Model

Model	Two seals	One seal
Rosemount 3051S_C	B12	B11
Rosemount 3051C	S2	S1
Rosemount 2051C	S2	S1
Rosemount 3051S_T	N/A	B11
Rosemount 3051T, 3051HT, 2051T, 2088	N/A	S1
Rosemount WPG	N/A	S1

A Rosemount 1199 Remote Mount Seal consists of two parts. First, specify the capillary model codes found on page 76. Then, specify a remote seal found on page 79.

Ordering codes

1199 _

Remote Mount Connection page 76 Seal Connection page 79

Capillary/fill fluid

Note
Use Table 18 on page-76 for Capillary Type Connections. Use Table 16 on page-70 for Direct Mount Type Connections.

Table 18. Rosemount 1199 Remote Mount Seal Systems Ordering Information

The starred offerings (★) represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Model	Product description			
1199	Seal system			
Connection type		**Seal system**	**Seal location**	
All coplanar devices (Rosemount 3051S_C, 3051C, and 2051C)				
W	Welded-repairable	One or two seal system	High side of transmitter	★
M	Welded-repairable	One or two seal system	Low side of transmitter	★
D	Welded-repairable	Two seal system	Balanced system - same seal on low and high side	★
R[(1)]	All welded	One seal system	High side of transmitter	★
T[(1)]	All welded	Two seal system	High side of transmitter	★
S[(1)]	All welded	Two seal system	Low side of transmitter	★
All In-line devices (Rosemount 3051S_T, 3051T, 3051HT, 2051T, 2088, and WPG)				
W	All welded	One seal system	N/A	★
Seal fill fluid		**Specific gravity at 77 °F (25 °C)**	**Temperature limits[(2)]**	
D	Silicone 200	0.93	–49 to 401 °F (–45 to 205 °C)	★
F	Silicone 200 for vacuum applications	0.93	For use in vacuum applications below 14.7 psia (1 bar-a), refer to vapor pressure curves in Rosemount DP Level Fill Fluid Specification Technical Note.	★
J[(5)]	Tri-Therm 300	0.795	–40 to 572 °F (–40 to 300 °C)	★
Q[(5)]	Tri-Therm 300 for vacuum Applications	0.795	For use in vacuum applications below 14.7 psia (1 bar-a), refer to vapor pressure curves in Rosemount DP Level Fill Fluid Specification Technical Note.	★
L[(3)]	Silicone 704	1.07	32 to 599 °F (0 to 315 °C)	★
C[(3)]	Silicone 704 for vacuum applications	1.07	For use in vacuum applications below 14.7 psia (1 bar-a), refer to vapor pressure curves in Rosemount DP Level Fill Fluid Specification Technical Note.	★
R[(3)]	Silicone 705	1.09	68 to 698 °F (20 to 370 °C)	★
V[(4)]	Silicone 705 for vacuum applications	1.09	For use in vacuum applications below 14.7 psia (1 bar-a), refer to vapor pressure curves in Rosemount DP Level Fill Fluid Specification Technical Note.	★
A	Syltherm XLT	0.85	–157 to 293 °F (–105 to 145 °C)	★
H	Inert (Halocarbon)	1.85	–49 to 320 °F (–45 to 160 °C)	★
G[(5)(6)]	Glycerin and water	1.13	5 to 203 °F (–15 to 95 °C)	★
N[(5)]	Neobee M-20	0.92	5 to 437 °F (–15 to 225 °C)	★
P[(5)(6)]	Propylene Glycol and water	1.02	5 to 203 °F (–15 to 95 °C)	★

Table 18. Rosemount 1199 Remote Mount Seal Systems Ordering Information

The starred offerings (★) represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Seal connection type/capillary ID, description		
B	0.03-in. (0,711 mm) ID	★
C	0.04-in. (1,092 mm) ID	★
D	0.075-in. (1,905 mm) ID	★
E[7]	0.03-in. (0,711 mm) ID, PVC coated with closed end	★
F[7]	0.04-in. (1,092 mm) ID, PVC coated with closed end	★
G[7]	0.075-in. (1,905 mm) ID, PVC coated with closed end	★
H	0.03-in. (0,711 mm) ID, 4-in. support tube	★
J	0.04-in. (1,092 mm) ID, 4-in. support tube	★
K	0.075-in. (1,905 mm) ID, 4-in. support tube	★
M[7]	0.03-in. (0,711 mm) ID, PVC coated, 4-in. support tube with closed end	★
N[7]	0.04-in. (1,092 mm) ID, PVC coated, 4-in. support tube with closed end	★
P[7]	0.075-in. (1,905 mm) ID, PVC PVC coated, 4-in. support tube with closed end	★
Capillary length[8]		
01	1 ft. (0,3 m)	★
05	5 ft. (1,5 m)	★
10	10 ft. (3,0 m)	★
15	15 ft. (4,5 m)	★
20	20 ft. (6,1 m)	★
51	1.6 ft. (0,5 m)	★
52	3.3 ft. (1,0 m)	★
53	4.9 ft. (1,5 m)	★
54	6.6 ft. (2,0 m)	★
55	8.2 ft. (2,5 m)	★
56	9.8 ft. (3,0 m)	★
57	11.5 ft. (3,5 m)	★
58	13.1 ft. (4,0 m)	★
59	16.4 ft. (5,0 m)	★
60	19.7 ft. (6,0 m)	★
25	25 ft. (7,6 m)	
30	30 ft. (9,1 m)	
35	35 ft. (10,7 m)	
40	40 ft. (12,2 m)	
45	45 ft. (13,7 m)	
50	50 ft. (15,2 m)	

Table 18. Rosemount 1199 Remote Mount Seal Systems Ordering Information

The starred offerings (★) represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Capillary length[8]		
61	23 ft. (7,0 m)	
62	26.2 ft. (8,0 m)	
63	29.5 ft. (9,0 m)	
64	32.8 ft. (10,0 m)	
65	36.1 ft. (11,0 m)	
66	39.4 ft. (12,0 m)	
67	42.6 ft. (13,0 m)	
68	45.9 ft. (14,0 m)	
69	49.2 ft. (15,0 m)	

1. All welded system connection types require either a 316L SST or Alloy C-276 isolating diaphragm in the pressure transmitter model codes.
2. At ambient pressure of 14.7 psia (1 bar-a) and ambient temperature of 70 °F and must be further derated if ambient, temperature exceeds 70 °F (21 °C).
3. Only available with Seal Connection Type/Capillary ID, Description Codes C, D, F, G, J, K, N, and P.
4. Only available with Seal Connection Type/Capillary ID, Description Codes D, G, K, and P.
5. This is a food grade fill fluid.
6. Not suitable for vacuum applications.
7. PVC coating should not be exposed to temperatures above 212 °F (100 °C) to avoid the possibility of thermal breakdown.
8. For Submersible Seal TSM and FSM models, refer to the Rosemount 1199 Submersible Seal Product Data Sheet.

Flanged seals

FFW flush flanged seal

Table 19. FFW Flush Flanged Seal – Ordering Information

The starred offerings (★) represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Code	Industry standards			
A	ANSI/ASME B16.5 (American National Standards Institute/American Society of Mechanical Engineers)			★
D	EN 1092-1 (European Standard)			★
T	GOST 12815-80 (Russian Standard)			★
J	JIS B2238 (Japanese Industrial Standard)			
Process connection style				
FFW	Flush flanged seal			★
Process connection size				
	ANSI/ASME B16.5	**EN 1092-1/GOST 12815-80**	**JIS B2238**	
G	2-in.	DN 50	50 A	★
7	3-in.	N/A	80 A	★
J	N/A	DN 80	N/A	★
9	4-in.	DN 100	100 A	★
Flange/pressure rating				
1	Class 150	N/A	10K	★
2	Class 300	N/A	20K	★
4	Class 600	N/A	40K	★
G	N/A	PN 40	N/A	★
E	N/A	PN 10/16 (DN 100 only)	N/A	
5	Class 900	N/A	N/A	
6	Class 1500	N/A	N/A	
7	Class 2500	N/A	N/A	
H	N/A	PN 63	N/A	
J	N/A	PN 100	N/A	
K	N/A	PN 160	N/A	
Diaphragm and wetted, upper housing, flange material				
	Diaphragm and wetted	**Upper housing**	**Flange**	
CA[(1)(2)]	316L SST	316L SST	CS	★
DA[(2)]	316L SST	316L SST	316 SST	★
CB[(1)]	Alloy C-276, seam welded	316L SST	CS	★

Table 19. FFW Flush Flanged Seal – Ordering Information

The starred offerings (★) represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Diaphragm and wetted, upper housing, flange material				
DB	Alloy C-276, seam welded	316L SST	316 SST	★
CC[(1)]	Tantalum, seam welded	316L SST	CS	★
DC	Tantalum, seam welded	316L SST	316 SST	★
C3[(1)(2)(3)(4)]	Tantalum, brazed	316L SST	CS	★
D3[(1)(2)(3)(4)]	Tantalum, brazed	316L SST	316 SST	★
MB[(1)(2)]	Alloy C-276, solid faceplate	Alloy C-276/316L SST	CS	
KB[(1)(2)]	Alloy C-276, solid faceplate	Alloy C-276/316L SST	316 SST	
DJ	Alloy B, seam welded	316L SST	316 SST	
DF	304L SST, seam welded	316L SST	316 SST	
DV	Alloy 400, seam welded	316L SST	316 SST	
RH[(2)(5)]	Titanium Grade 4	Titanium GR.4	316 SST	
DH[(6)]	Titanium Grade 4, seam welded	316L SST	316 SST	
DE	Alloy 600, seam welded	316L SST	316 SST	
DP	Nickel 201, seam welded	316L SST	316 SST	
WW[(2)(7)]	316Ti SST (WNr 1.4571)	316Ti SST (WNr 1.4571)	316Ti SST (WNr 1.4571)	
DZ[(6)]	Zirconium 702, seam welded	316L SST	316 SST	
D4	Alloy C-22, seam welded	316L SST	316 SST	
D5	Duplex 2507 SST, seam welded	316L SST	316 SST	
CP	Nickel 201	316L SST	CS	
CV	Alloy 400	316L SST	CS	
CH[(6)]	Titanium Grade 4	316L SST	CS	
C5	Duplex 2507 SST	316L SST	CS	
Flushing connection ring material (lower housing)[(8)]				
0	None			★
A	316L SST			★
B	Alloy C-276			★
2	Duplex 2205 SST			
H	Titanium Grade 4			
6	Nickel 201			
V	Alloy 400			
Flushing connection options, quantity (size)				
0	None			★
1	1 (1/4–18 NPT)			★
3	2 (1/4–18 NPT)			★
7	1 (1/2–14 NPT)			★
9	2 (1/2–14 NPT)			★

PROJECT :	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS			ELECTRO CHLORINATION SYSTEM			
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED			TECHNICAL DATASHEET FOR LEVEL TRANSMITTER			
BIDDER / VENDOR	DE NORA INDIA LIMITED			BHEL DOC. No. : PE-V11-412-174-A115			Rev
GENERAL	1	Tag No.			90PBM51CL003		
	2	Quantity			1		
	3	Service			BULK ACID STORAGE TANK LEVEL		
	4	Type			NON CONTACT RADAR		
PROCESS CONDITIONS	5	Duty			CONTINUOUS		
	6	Fluid			HYDROCHLORIC ACID		
	7	Specific Gravity			1.029		
	8	Operating Pressure		Kg/Cm2	ATM		
	9	Operating Temperature		DEG C	AMBIENT		
	10	Humidity		%	5 ~ 100		
	11	Vessel Diameter And Type		mm	2200	Cylindrical Horizontal	
	12	Lower Material Level		mm	0		
	13	Upper Material Level		mm	2000		
TRANSMITTER	14	Output signal type		mA	4 - 20 mA		
	15	Enclosure type number			IP 65		
	16	Elect. conn size Type			1/2 " 14 NPT		
	17	Digital communication			HART Protocal		
	18	Signal power source			24VDc 2 Wire		
	19	Enclosure material			Die Cast Alluminium Polyeurathene covered		
	20	Display			LCD		
	21	Calibration:			Self Calibration with internal referance, Zero & Span Calibration		
	22	Instrument Range Max		Meter	40		
SENSING ELEMENT	23	End Connection Size			2 " / ANSI, 150 Lbs Raised Face Flanged / SS 316L		
	24	Operating Principle			Frequency Modulated Continuous Wave (FMWC)		
	25	Sensor type			Process Seal		
	26	Antenna Size and Material			Process Seal, 2" (DN50) PTFE		
	27	Operating Temperature		degC	- 60 to 200		
	28	Mounting Location			Top of Tank		
PERFORMANCE	29	Accuracy			± 2mm		
Accessories	30	SS Tag Plate with Tag no. and service Engraved					
	31	SS316 Nut and Bolts with 2 Nos of Washer, EPDM gasket 3mm					
MISCELLANEOUS	32	Model Number	548A1SHA1NA7R2AASAA2M5Q4				
	33	Make	EMERSON PROCESS MANAGEMENT				
INSTRUMENT INDEX	Measurment/ Test		Input Min Range	Input Max range	Output Min Range	Output Max range	
	Level Output signal		0 mm	2500 mm	4 mA	20 mA	

PROJECT :	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS			ELECTRO CHLORINATION SYSTEM			
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED			TECHNICAL DATASHEET FOR LEVEL TRANSMITTER			
BIDDER / VENDOR	DE NORA INDIA LIMITED			BHEL DOC. No. : PE-V11-412-174-A115			Rev
GENERAL	1	Tag No.			90PBM50CL001		
	2	Quantity			1		
	3	Service			5% HCL ACID STORAGE TANK LEVEL		
	4	Type			NON CONTACT RADAR		
PROCESS CONDITIONS	5	Duty			CONTINUOUS		
	6	Fluid			HYDROCHLORIC ACID		
	7	Specific Gravity			1.029		
	8	Operating Pressure		Kg/Cm2	ATM		
	9	Operating Temperature		DEG C	AMBIENT		
	10	Humidity		%	5 ~ 100		
	11	Vessel Height And Type		mm	2550	Cylindrical Vertical	
	12	Lower Material Level		mm	0		
	13	Upper Material Level		mm	2040		
TRANSMITTER	14	Output signal type		mA	4 - 20 mA		
	15	Enclosure type number			IP 65		
	16	Elect. conn size Type			1/2" 14 NPT		
	17	Digital communication			HART Protocal		
	18	Signal power source			24VDc 2 Wire		
	19	Enclosure material			Die Cast Alluminium Polyeurathene covered		
	20	Display			LCD		
	21	Calibration:			Self Calibration with internal referance, Zero & Span Calibration		
	22	Instrument Range Max		Meter	40		
SENSING ELEMENT	23	End Connection Size			2" / ANSI, 150 Lbs Raised Face Flanged / SS 316L		
	24	Operating Principle			Frequency Modulated Continuous Wave (FMWC)		
	25	Sensor type			Process Seal		
	26	Antenna Size and Material			Process Seal, 2" (DN50) PTFE		
	27	Operating Temperature		degC	- 60 to 200		
	28	Mounting Location			Top of Tank		
PERFORMANCE	29	Accuracy			± 2mm		
Accessories	30	SS Tag Plate with Tag no. and service Engraved					
	31	SS316 Nut and Bolts with 2 Nos of Washer, EPDM gasket 3mm					
MISCELLANEOUS	32	Model Number	548A1SHA1NA7R2AASAA2M5Q4				
	33	Make	EMERSON PROCESS MANAGEMENT				
INSTRUMENT INDEX	Measurment/ Test		Input Min Range	Input Max range	Output Min Range	Output Max range	
	Level Output signal		0 mm	3000 mm	4 mA	20 mA	

PROJECT :	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS		ELECTRO CHLORINATION SYSTEM			
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED		TECHNICAL DATASHEET FOR LEVEL TRANSMITTER			
BIDDER / VENDOR	DE NORA INDIA LIMITED		BHEL DOC. No. : PE-V11-412-174-A115			Rev
GENERAL	1	Tag Number		90PBM40CL001, 90PBM40CL002, 90PBM40CL004, 90PBM40CL005		
	2	Quantity		4 Nos		
	3	Service		Level of Sodium Hypochlorite Storage Tank		
	4	Type		Ultrasonic		
	5	Location		FIELD		
PROCESS CONDITIONS	6	Duty		CONTINUOUS		
	7	Fluid		SEAWATER + Sodium Hypochlorite		
	8	Specific Gravity		1.025		
	9	Operating Pressure	Kg/Cm2	ATM		
	10	Operating Temperature	DEG C	25 ~ 37		
	11	Humidity	%	5 ~ 100		
	12	Vessel Height And Type	mm	7500 (tangent to tangent)	Cylindrical Vertical	
	13	Lower Material Level	mm	0		
	14	Upper Material Level	mm	6375		
TRANSMITTER	15	Output signal type	mA	4 - 20 mA		
	16	Elect. conn size Type		M20 x 1.5 (2 Nos)		
	17	Digital communication		HART Protocal		
	18	Signal power source		24VDc 2 Wire		
	19	Enclosure material		Glas Filled Nylon		
	20	Display		LCD (Integral)		
	21	Enclosure Protection		IP 66		
	22	span Zero Adjustment		integral push Button		
	23	Instrument Range	mm	300 ~ 11000		
SENSING ELEMENT	24	Process Connection Size		2" NPT		
	25	End Connection Mounting		CPVC 2" Female threaded Flange		
	26	Operating Principle		Detection of reflected Ultrasonic Pulse		
	27	Sensor Material		PVDF		
	28	Maximum Temperature	degC	70		
PERFORMANCE	29	Accuracy		0.25% of measured distance		
	30	Resolution		Better Than 0.04 in. (1 mm)		
Accessories	31	SS Tag Plate with Tag no. and service Engraved				
	32	SS316 Nut and Bolts with 2 Nos of Washer, EPDM gasket 3mm				
MISCELLANEOUS	33	MAKE		EMERSON PROCESS MANAGEMENT		
	34	MODEL		3102HP3FRCNAQ4ST		

INSTRUMENT INDEX	Measurment/ Test	Input Min Range	Input Max range	Output Min Range	Output Max range	
	Level Output signal	0 mm	8500 mm	4 mA	20 mA	

PROJECT :	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS			ELECTRO CHLORINATION SYSTEM			
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED			TECHNICAL DATASHEET FOR LEVEL TRANSMITTER			
BIDDER / VENDOR	DE NORA INDIA LIMITED			BHEL DOC. No. : PE-V11-412-174-A115			Rev
GENERAL	1	Tag Number			90PBM70CL001, 90PBM70CL001		
	2	Quantity		Nos	2		
	3	Service			LEVEL OF HYPOCHLORITE STORAGE TANK AT SEA WATER INTAKE		
	4	Type			Ultrasonic		
	5	Location			FIELD		
PROCESS CONDITIONS	6	Duty			CONTINUOUS		
	7	Fluid			SEAWATER + Sodium Hypochlorite		
	8	Specific Gravity			1.025		
	9	Operating Pressure		Kg/Cm2	ATM		
	10	Operating Temperature		DEG C	25 ~ 37		
	11	Humidity		%	5 ~ 100		
		Vessel Height And Type		mm	3000 (tangent to tangent)	Cylindrical Vertical	
	12	Lower Material Level		mm	0		
	13	Upper Material Level		mm	2250		
TRANSMITTER	14	Output signal type		mA	4 - 20 mA		
	15	Elect. conn size Type			M20 x 1.5 (2 Nos)		
	16	Digital communication			HART Protocal		
	17	Signal power source			24VDc 2 Wire		
	18	Enclosure material			Glas Filled Nylon		
	19	Display			LCD (Integral)		
	20	Enclosure Protection			IP 66		
	21	span Zero Adjustment			integral push Button		
	22	Instrument Range		mm	300 ~ 11000		
SENSING ELEMENT	23	Process Connection Size			2" NPT		
	24	End Connection Mounting			CPVC 2" Female threaded Flange		
	25	Operating Principle			Detection of reflected Ultrasonic Pulse		
	26	Sensor Material			PVDF		
	27	Maximum Temperature		degC	70		
PERFORMANCE	28	Accuracy			0.25% of measured distance		
	29	Resolution			Better Than 0.04 in. (1 mm)		
Accessories	30	SS Tag Plate with Tag no. and service Engraved					
	31	SS316 Nut and Bolts with 2 Nos of Washer, EPDM gasket 3mm					
MISCELLANEOUS	32	MAKE			EMERSON PROCESS MANAGEMENT		
	33	MODEL			3102HP3FRCNAQ4ST		

INSTRUMENT INDEX	Measurment/ Test	Input Min Range	Input Max range	Output Min Range	Output Max range	
	Level Output signal	0 mm	3500 mm	4 mA	20 mA	

PROJECT :	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS			ELECTRO CHLORINATION SYSTEM		
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED			TECHNICAL DATASHEET FOR LEVEL TRANSMITTER		
BIDDER / VENDOR	DE NORA INDIA LIMITED			BHEL DOC. No. : PE-V11-412-174-A115		Rev
GENERAL	1	Tag Number			90PBM60CL001	
	2	Quantity		Nos	1	
	3	Service			LEVEL OF NUTRALIZATION PIT	
	4	Type			Ultrasonic	
	5	Location			FIELD	
PROCESS CONDITIONS	6	Duty			CONTINUOUS	
	7	Fluid			Nutralized Liquid	
	8	Specific Gravity			1.022	
	9	Operating Pressure		Kg/Cm2	ATM	
	10	Operating Temperature		DEG C	25 ~ 37	
	11	Humidity		%	5 ~ 100	
	12	Pit Depth / Type			3000 mm	RCC
	13	Lower Material Level		mm	0	
	14	Upper Material Level		mm	2100	
TRANSMITTER	15	Output signal type		mA	4 - 20 mA	
	16	Elect. conn size Type			M20 x 1.5 (2 Nos)	
	17	Digital communication			HART Protocal	
	18	Signal power source			24VDc 2 Wire	
	19	Enclosure material			Glas Filled Nylon	
	20	Display			LCD (Integral)	
	21	Enclosure Protection			IP 66	
	22	span Zero Adjustment			integral push Button	
	23	Instrument Range		mm	300 ~ 11000	
SENSING ELEMENT	24	Process Connection Size			2" NPT	
	25	End Connection Mounting			CPVC 2" Female threaded Flange	
	26	Operating Principle			Detection of reflected Ultrasonic Pulse	
	27	Sensor Material			PVDF	
	28	Maximum Temperature		degC	70	
PERFORMANCE	29	Accuracy			0.25% of measured distance	
	30	Resolution			Better Than 0.04 in. (1 mm)	
Accessories	31	SS Tag Plate with Tag no. and service Engraved				
	32	SS316 Nut and Bolts with 2 Nos of Washer, EPDM gasket 3mm				
MISCELLANEOUS	33	MAKE			EMERSON PROCESS MANAGEMENT	
	34	MODEL			3102HP3FRCNAQ4ST	

INSTRUMENT INDEX	Measurment/ Test	Input Min Range	Input Max range	Output Min Range	Output Max range	
	Level Output signal	0 mm	3500 mm	4 mA	20 mA	

Rosemount 3101, 3102, and 3105

Ultrasonic Liquid Level Transmitters

- Non-contacting measurement with no moving parts
- Integral LCD and buttons as standard for on-site programming
- Continuous measurement of level
- Volume or open channel flow calculations for the Rosemount 3102 and Rosemount 3105
- Two integral signal relays on the Rosemount 3102
- Easy to install and configure
- Rugged metal or plastic housing. PVDF wetted material
- Two-wire direct current loop-powered

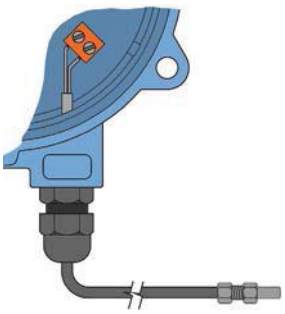
ROSEMOUNT®

EMERSON™
Process Management

Overview of the Rosemount 3101, 3102, and 3105

Metal housing material (1/2–14 NPT conduit entries)

Glass-filled nylon housing material



Remote Temperature Sensor option (for the 3102 and 3105)

Applications

- Storage tank levels
- Open channel flow
- Effluent pits
- Reservoir level
- Buffer tanks

Measurement principle

The Rosemount 3100 Series is a liquid level transmitter based on ultrasonic technology that is suitable for many liquid applications. Ultrasonic pulse signals are transmitted and reflected from the liquid surface. The transmitter 'listens' for reflected signals (echoes) and measures the time-delay between transmitting and receiving. The distance to the liquid surface is automatically calculated using the computed time-delay.

The transmitter then calculates the liquid depth (level) and outputs the level as a 4–20 mA signal (and a digital HART® signal on the Rosemount 3102 and 3105).

The Rosemount 3101 is used for measuring the level only. The 3102 and 3105 can calculate distance-to-surface, contents (volume), or open channel flow, and then output the result as a 4–20 mA signal and a digital HART signal.

An integral temperature sensor continuously measures the air temperature around the transmitter. It then computes the speed of sound in air, automatically compensating the calculated distance for temperature effects. The Rosemount 3102 and 3105 have a Remote Temperature Sensor option.

Features and Benefits

- Measures liquid height, distance to liquid, volume, or flow in open channels
- Eliminates problems experienced with contacting instrumentation
- Simple set-up and operation with an integral LCD display and buttons
- Low cost of installation and commissioning. Minimal maintenance after installed
- Process downtime minimized
- Non-contacting measurement with no moving parts
- Two integral signal relays (on the Rosemount 3102 only)
- Corrosion resistant PVDF wetted material
- Two-wire 24 V direct current loop-powered
- Operating range up to 36 ft. (11 m)
- Automatic temperature compensation

Contents

Rosemount 3102 Level Transmitter Ordering

Specification and selection of product materials, options, or components must be made by the purchaser of the equipment.
See page 9 for more information on Material Selections.

Table 3. Rosemount 3102 ordering information

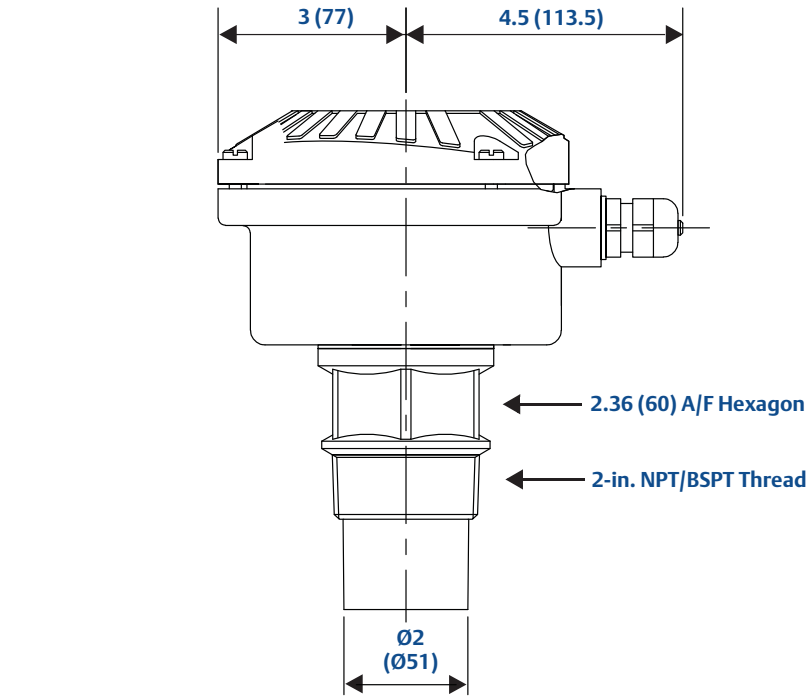
★The Standard offering represents the most common models and options. These options should be selected for best delivery.
The Expanded offering is manufactured after receipt of order and is subject to additional delivery lead time.

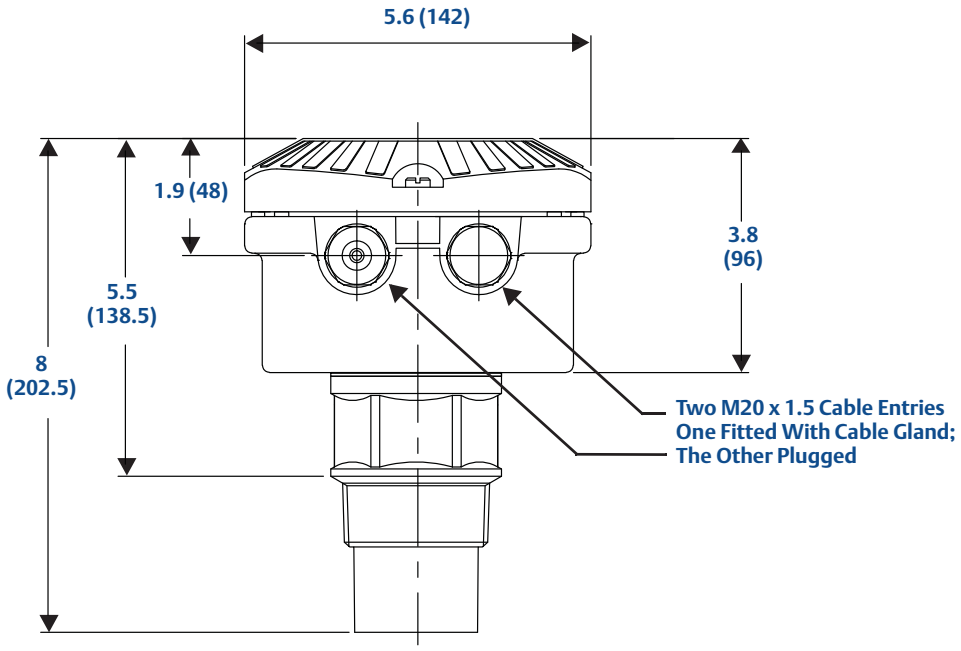
Model	Product Description	
3102	Ultrasonic Level Transmitter with 2 integral relays, 1 to 36 ft. (0,3 to 11 m) range	
Signal Output		
Standard		**Standard**
H	4–20 mA with HART communication	★
Housing Material		
Standard		**Standard**
A	Polyurethane-covered Aluminum	★
P	Glass Filled Nylon	★
Conduit / Cable Thread		
Standard		**Standard**
1	½ –14 NPT	★
2	M20 x 1.5 adaptor	★
3	M20 x 1.5 supplied with nylon glands (Plastic Housing only)	★
Wetted Material		
Standard		**Standard**
F	PVDF	★
Process Connection		
Standard		**Standard**
RC(1)	2-in. NPT thread	★
SC(2)	2-in. BSPT thread	★
Product Certificates		
Standard		**Standard**
NA	No certification	★
G5	FM Ordinary Location	★
G6	CSA Ordinary Location	★
GM(3)	Technical Regulation Customs Union (EAC) Ordinary Locations Mark	★
GP(3)	Korean Testing Laboratory (KTL), KCC mark for ordinary location use	★
OPTIONS		
Special Alarm Options(4)		
Standard		**Standard**
C4	Namur NE43 alarm and saturation levels, high alarm	★
C5	Namur NE43 alarm and saturation levels, low alarm	★
C8	Standard Rosemount alarm and saturation levels, low alarm	★
Special Certification Option		
Standard		**Standard**
Q4	Certificate of functional test	★
Tag Plates		
Standard		**Standard**
ST(5)	Stainless Steel engraved tag plate	★
WT	Laminated paper tag plate	★
Typical Model Number: 3102 H A 1 F RC G5 C4 ST		

(1) Choosing this option implies US (Imperial) units of measurement of feet are required for the default configuration. Configuration can be changed on-site.
(2) Choosing this option implies Metric units of measurement of meters are required for the default configuration. Configuration can be changed on-site.
(3) Contact an Emerson Process Management representative for additional information.
(4) When no Special Alarm option code is selected, the configuration is pre-set for a high-signal alarm indication, and standard Rosemount alarm and saturation levels (see "Electrical" on page 8 for details).
(5) The maximum number of characters that can be engraved is 16.

Plastic housing

Note: Dimensions are in inches (mm).





Rosemount™ 5408 and 5408:SIS Level Transmitters

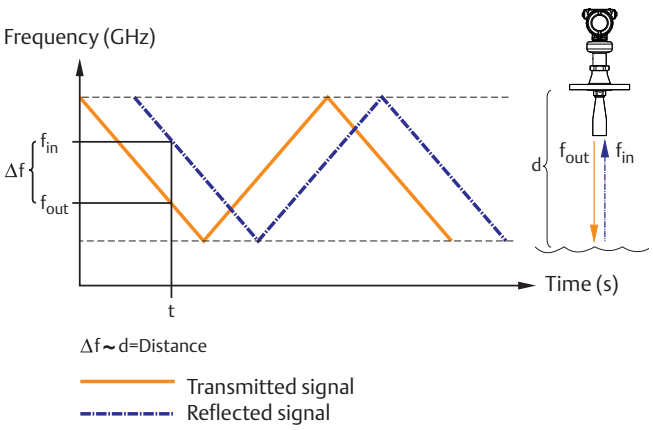
Non-Contacting Radar

HART COMMUNICATION PROTOCOL

- Unique energy-efficient two-wire FMCW radar technology for optimal performance
- Engineered and user tested for best in class safety, reliability, and ease-of-use
- Built on 40 years of inventing and redefining radar level measurement
- Intuitive commissioning experience driven by wizards and adaptive graphics
- Rosemount 5408:SIS, optimal for safety applications and IEC 61508 certified to SIL 2
- Safe, easy, and remote proof testing without process interruptions

EMERSON

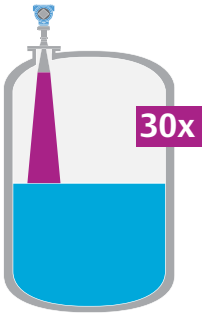
Introduction



Measurement principle

The Rosemount 5408 and 5408:SIS are two-wire non-contacting radar transmitters for continuous level measurement of liquids, slurries, and solids. The measurement principle is fast-sweep Frequency Modulated Continuous Wave (FMCW).

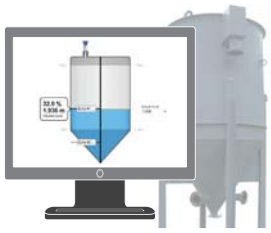
Radar signals are continuously transmitted towards the product surface with a microwave frequency modulated over a span. The level is proportional to the frequency difference between currently received and transmitted signal.



Technology to redefine reliability

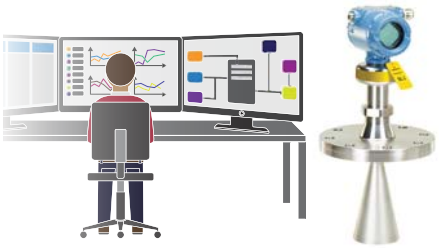
The Rosemount 5408 and 5408:SIS are optimized for reliable and accurate performance even in challenging process conditions. FMCW technology maximizes radar signal strength and produces a robust and reliable measurement (with 30 times more power on the surface than traditional two-wire non-contacting radars).

The transmitters can operate with only 12 Vdc lift-off voltage and they are self-powered for up to 2 seconds to maintain operation despite cable glitches or lightning.



Ease-of-use at every touch point

The Rosemount 5408 and 5408:SIS are designed to simplify operator tasks. They deliver ease-of-use at every touch point, from the pictorial user instructions and graphical, intuitive wizards to the PTFE seal that requires no O-ring material for simplifying model selection.



Dedicated to safety

The Smart Diagnostics Suite provides operators with early alerts in case of antenna build-up, weak power supply, or abnormal surface conditions. Also, a local memory enables full insight into the last seven days of measurements, alerts, and echo profiles.

The Rosemount 5408:SIS is the ideal choice for functional safety such as overfill prevention. It is safety certified (SIL 2/SIL 3), supports long proof-test intervals guaranteed to suit your schedule, and can be tested remotely without any process interruption.

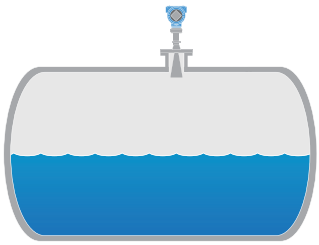
Contents

Application examples

The Rosemount 5408 and 5408:SIS are ideal for level measurements over a broad range of liquid and solids applications. The transmitters are virtually unaffected by changing density, temperature, pressure, media dielectric, pH, and viscosity. Furthermore, non-contacting radar level is ideal when internal tank obstructions are a limiting factor.

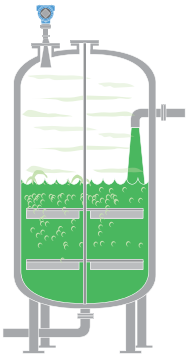
Storage and buffer tanks

The Rosemount 5408 provides accurate and reliable level measurement for both metallic or non-metallic vessels containing almost any liquid (e.g. oil, gas condensate, water, chemicals).



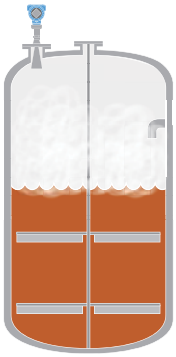
Reactors

The Rosemount 5408 is ideal for the most challenging applications, including reactors where there can be agitation, foaming, condensation as well as high temperatures and pressures.



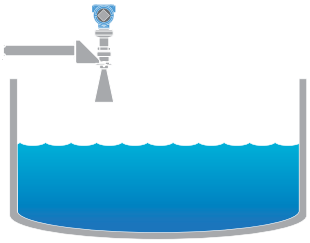
Blenders and mixers

The Rosemount 5408 can help you withstand the rigors of blenders and mixing tanks. Easy to install and commission, it is also unaffected by virtually any fluid property change.



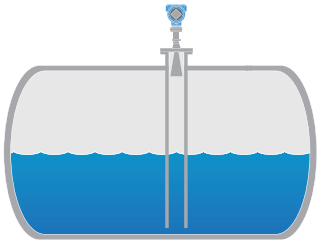
Open atmospheric applications

The Rosemount 5408 measures reliably in open applications, from short range sumps or ponds to long range dams.



Still pipe and chamber installations

The Rosemount 5408 is an excellent choice for level measurement in tanks with still pipes. It may also be used in chambers, but guided wave radar is generally the best fit for these applications.

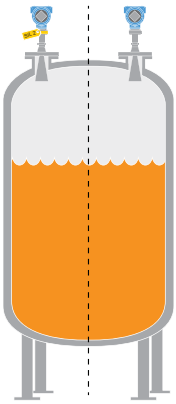


Bulk solids

The Rosemount 5408 is the ideal solution for small to medium sized silos with rapid level changes. The narrow beam avoids internal obstructions while still keeping good level measurement.

Safety applications

The Rosemount 5408:SIS is the ideal choice for safety functions such as overfill prevention, level deviation monitoring or dry-run prevention.



Ordering Information

Rosemount 5408 Level Transmitter

The Rosemount 5408 is a two-wire non-contacting radar transmitter for level measurements over a broad range of liquids and slurries. It uses a unique energy efficient radar technology based on the FMCW principle to ensure reliable performance even in challenging conditions.

Specification and selection of product materials, options, or components must be made by the purchaser of the equipment. See page 23 for more information on material selection.

Table 1. Rosemount 5408 Level Transmitter Ordering Information

The starred offerings (★) represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Model	Product description	
5408	Radar Level Transmitter	★
Profile		
A	Standard Monitoring & Control Applications	★
Measurement type		
1	Liquid Level Measurement	★
3	Solids Level Measurement	★
4	Liquid & Solids Level Measurement	★
Performance class		
S	Standard	★
Signal output		
H	4–20 mA with digital signal based on HART® Revision 6 protocol (HART Revision 7 available as option)	★
Housing material		
A	Aluminum	★
S	Stainless Steel (SST)	★
Conduit/cable threads		
1	½-14 NPT	★
2	M20 x 1.5	★
3(1)	G½	
Hazardous locations certifications		
NA	None	★
E1	ATEX Flameproof	★

Table 1. Rosemount 5408 Level Transmitter Ordering Information

The starred offerings (★) represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

I1	ATEX Intrinsic Safety			★
N1	ATEX Type n			★
E5	FM Explosion-proof, Dust Ignition-proof			★
I5	FM Intrinsically Safe; Nonincendive			★
E6	Canadian Explosion-proof, Dust Ignition-proof			★
I6	Canadian Intrinsically Safe; Nonincendive			★
E7	IECEx Flameproof, Dust Ignition-proof			★
I7	IECEx Intrinsic Safety			★
N7	IECEx Type n			★
E2	INMETRO (Brazil) Flameproof			★
I2	INMETRO (Brazil) Intrinsic Safety			★
N2	INMETRO (Brazil) Type n			★
E3	NEPSI (China) Flameproof			★
I3	NEPSI (China) Intrinsic Safety			★
N3	NEPSI (China) Type n			★
IP	KCCs (Korea) Intrinsic Safety			★
Materials of construction			**Available antenna types**	
1	316/316L/EN 1.4404		Cone, Parabolic	★
7	All PTFE Wetted Parts		Process Seal	★
Process connection type			**Available antenna types**	
F[2]	Flat Face Flange		Cone, Parabolic	★
R[3]	Raised Face Flange		All	★
N	NPT Thread		Cone	★
G	BSPP (G) Thread		Cone, Parabolic	★
B	Bracket Mounting		Cone	★
C	Tri Clamp		Process Seal	★
W	Welded Connection		Parabolic	★
Process connection size		**Available process connections**	**Available antenna types**	
A	1½-in.	Thread	Cone	★
2	2-in./DN50/50A	Flange, Thread[4], Tri Clamp[5]	Cone, Process Seal	★
3	3-in./DN80/80A	Flange, Thread[4], Tri Clamp[5]	Cone, Process Seal	★
B	3½-in.	Thread, Welded	Parabolic	★
4	4-in./DN100/100A	Flange, Thread[4]	Cone, Process Seal	★

Table 1. Rosemount 5408 Level Transmitter Ordering Information

The starred offerings (★) represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

6	6-in./DN150/150A	Flange	Cone	★
8	8-in./DN200/200A	Flange	Cone, Parabolic	★
T	10-in./DN250/250A	Flange	Parabolic	★
Z	None (use when ordering bracket mounting)	Bracket Mounting	Cone	★
Process connection rating (see Table 3, Table 4, and Table 5 for available flanges)				
ZZ	For use with non-flange process connection type			★
ASME flanges				
AA	ASME B16.5 Class 150			★
AB	ASME B16.5 Class 300			★
AC	ASME B16.5 Class 600			★
EN flanges		**Note**		
DK	EN1092-1 PN6	N/A		★
DA	EN1092-1 PN16	PN10 and PN16 dimensions are identical for DN50 to DN150		★
DB	EN1092-1 PN40	PN25 and PN40 dimensions are identical for DN50 to DN150		★
DC	EN1092-1 PN63	N/A		★
DD	EN1092-1 PN100	N/A		★
JIS flanges				
JK	JIS 5K			★
JA	JIS 10K			★
JB	JIS 20K			★
Antenna type		**Operating pressure**	**Operating temperature**	
CAA	Cone Antenna (PTFE seal)	-15 to 363 psig (-1 to 25 bar)	-76 to 392 °F (-60 to 200 °C)	★
CAB	Cone Antenna (PTFE seal)	-15 to 725 psig (-1 to 50 bar)(6)	-40 to 302 °F (-40 to 150 °C)	★
CAC	Cone Antenna (PTFE seal)	-15 to 1450 psig (-1 to 100 bar)	-40 to 212 °F (-40 to 100 °C)	★
CAD	Cone Antenna (PTFE seal)	-15 to 44 psig (-1 to 3 bar)	-76 to 482 °F (-60 to 250 °C)	★
CBF	Cone Antenna (PEEK seal, FVMQ)	-15 to 754 psig (-1 to 52 bar)	-76 to 338 °F (-60 to 170 °C)	★
CBK	Cone Antenna (PEEK seal, Kalrez® 6375)	-15 to 754 psig (-1 to 52 bar)	5 to 482 °F (-15 to 250 °C)	★
CBM	Cone Antenna (PEEK seal, FKM)	-15 to 754 psig (-1 to 52 bar)	-13 to 428 °F (-25 to 220 °C)	★
CBV	Cone Antenna (PEEK seal, Viton®)	-15 to 754 psig (-1 to 52 bar)	-22 to 392 °F (-30 to 200 °C)	★
SAA	Process Seal Antenna	-7 to 363 psig (-0.5 to 25 bar)(7)	-76 to 392 °F (-60 to 200 °C)(7)	★
PAS	Parabolic Antenna, Swivel Mount	-7 to 43 psig (-0.5 to 3 bar)	-67 to 392 °F (-55 to 200 °C)	★

Table 1. Rosemount 5408 Level Transmitter Ordering Information

The starred offerings (★) represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Antenna size		Available antenna types	
2	2-in. (DN50)	Cone, Process Seal	★
3	3-in. (DN80)	Cone, Process Seal	★
4	4-in. (DN100)	Cone, Process Seal	★
8	8-in. (DN200)	Parabolic	★

Options (include with selected model number)

Antenna extensions (see page 38)		Total length	
S1	Extended Cone Antenna	24-in. (600 mm)	★
S2	Extended Cone Antenna, Segmented	48-in. (1200 mm)	★
Purging connection (see page 23)[8]			
PC1	Purging Connector (Purge Ring)		★
Display			
M5	LCD Display		★
Functional safety options			
EF1	Ready for upgrade to Rosemount 5408:SIS		★
Diagnostic functionality			
DA1	Smart Diagnostics Suite (see page 21)		★
HART revision configuration			
HR7	4-20 mA with digital signal based on HART Revision 7 protocol		★
Open air applications configuration[9]			
OA	Open Air Applications Configuration; LPR (Level Probing Radar)		★
Factory configuration			
C1	Factory Configuration per Configuration Data Sheet		★
Alarm limits			
C4	NAMUR Alarm and Saturation Levels, High Alarm		★
C5	NAMUR Alarm and Saturation Levels, Low Alarm		★
C8[10]	Standard Rosemount Alarm and Saturation Levels, Low Alarm		★
Welding standard for flanges[11]			
AW	According to ASME IX		★
EW	According to EN-ISO		★

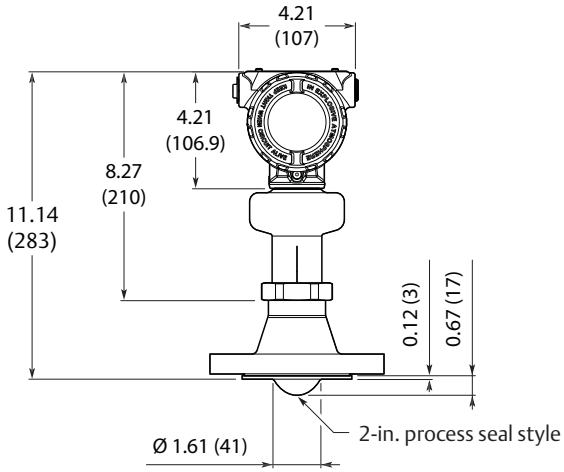
Table 1. Rosemount 5408 Level Transmitter Ordering Information

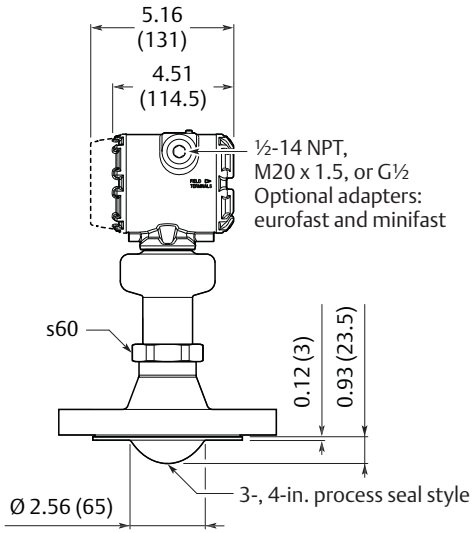
The starred offerings (★) represent the most common options and should be selected for best delivery. The non-starred offerings are subject to additional delivery lead time.

Special quality assurance		
Q4	Calibration Data Certificate	★
Hydrostatic testing[12]		
Q5	Hydrostatic Testing, including certificate	★
Material traceability certification[13]		
Q8	Material Traceability Certification per EN 10204 3.1 (2.1 for non-metallic)	★
Materials certification[14]		
Q15	NACE® Material Recommendation per NACE MR0175/ISO 15156	★
Q25	NACE Material Recommendation per ANSI/NACE MR0103/ISO 17495-1	★
Q35	NACE Material Recommendation per NACE MR0175/ISO 15156 and ANSI/NACE MR0103/ISO 17495-1	★
Welding procedure qualification record documentation[11]		
Q66	Welding Procedure Qualification Record (WPQR)	★
Q67	Welder Performance Qualification (WPQ)	★
Q68	Welding Procedure Specification (WPS)	★
Q79	WPQR/WPQ/WPS	★
Dye penetration test certificate[11]		
Q73	Certificate of Liquid Penetrant Inspection	★
Positive material identification certificate		
Q76	Positive Material Identification Certificate of Conformance	★
Extended product warranty		
WR3	3-year Limited Warranty	★
WR5	5-year Limited Warranty	★
Conduit electrical connector (shipped uninstalled)[15]		
EC	M 12, 4-pin, Male connector (eurofast®)	★
MC	A size Mini, 4-pin, Male connector (minifast®)	★
Specials (see page 24)		
PXXXX	Custom Engineered Solutions beyond standard model codes. Consult factory for details.	
Typical model number: 5408 A 1 S H A 1 E5 1 R 3 AB CAB 3 M5 DA1		

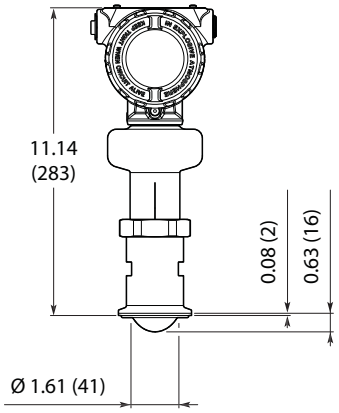
1. G½ thread form is not available with hazardous locations approvals.
2. Type A flat face for EN 1092-1 flanges.
3. Type B1 raised face for EN 1092-1 flanges.
4. Only available with cone antenna.
5. Only available with process seal antenna.

Figure 18. Process Seal Antenna

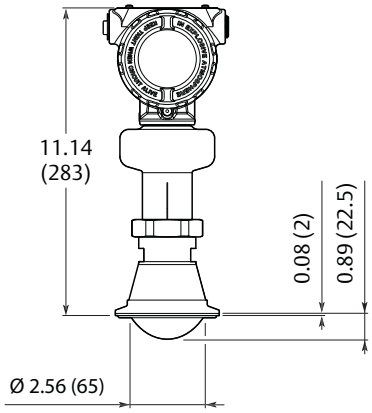




Tri Clamp
2-in.



Tri Clamp
3-in.



Dimensions are in inches (millimeters).

PROJECT :	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS		ELECTRO CHLORINATION SYSTEM		
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED		TECHNICAL DATASHEET OF DIFF. PRESSURE GAUGE		
BIDDER / VENDOR	DE NORA INDIA LIMITED		BHEL DOC. No. : PE-V11-412-174-A115		Rev
GENERAL	1	Tag Number		90PBM21CP001, 90PBM22CP001	
	2	Service		ACROSS SEA WATER AUTO STRAINER	
	3	Location		Field	
	4	QTY		2	
	5	TYPE		Diff. Pressure gauge with diaphragm seal unit	
PROCESS CONDITIONS	6	DUTY		CONTINUOUS	
	7	FLUID HANDLED		SEA WATER	
	8	SPEC. GRAVITY		1.02	
	9	TEMPERATURE	Deg C	25 ~ 32	
	10	PRESSURE	Bar	1 - 2	
	11	DESIGN TEMPERATURE	Deg C	50	
	12	DESIGN PRESSURE	Bar	5	
	13	HUMIDITY	%	5 ~ 100	
PROCESS CONNECTION AND CASE	14	Case type		Dry case	
	15	Case style		Manufacturer standard	
	16	Gauge size		150mm	
	17	Process connection size		1/2 " NPT M	
	18	Process connection location		Bottom Entry	
	19	Case pressure relief type		Rubber Blow out disc	
	20	Ring style		Bayonet Bezel	
	21	Mounting type		2" PIPE MOUNTING	
	22	Case material		SS304 with bayonet benzel	
	23	Window material		Shatterproof glass	
PRESSURE ELEMENT AND MOVEMENT	24	Elastic element type		SS316	
	25	Nom accuracy grade		± 2% FSD for 10% to 90% of measuring span	
	26	Element Material		SS316	
	27	Movement material		SS304	
DIAL AND POINTER	28	Dial scale type		single scale	
	29	Zero adjustment		Yes - micrometer Pointer	
	30	Graduations and color		White background , black markings	
	31	Scale range type	Bar	0 to 1	
	32	Dial material		Aluminium	
DIAPHRAGM SEALS / ISOLATOR	33	Seal type		Diaphragm seal	
	34	Process conn typ | Style		1/2 "NPT (M)threaded	
	35	Instr conn nom size		1/2 "	
	36	Diaphragm material		Monel	
	37	Bolting material		SS316	
	38	Upper housing material		SS316	
	39	Lower housing material		Monel	
	40	Fill fluid material		SILICONE OIL	
MAKE	41	GOA THERMOSTATIC			
MODEL	42	DPG110# Series D-BL-B-PM-6-S4-S6-S6-S4-Range-SU11-5M-Mo-S6-Mo-3N(1/2"NPTM)-Op0			
ACCESSORIES	Armoured capillary shall be provided of length 5 Meter in SS316				
	mounting bracket				

PROJECT :	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS		ELECTRO CHLORINATION SYSTEM		
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED		TECHNICAL DATASHEET OF DIFF. PRESSURE GAUGE		
BIDDER / VENDOR	DE NORA INDIA LIMITED		BHEL DOC. No. : PE-V11-412-174-A115		Rev
GENERAL	1	Tag Number		90PBM40CP001, 90PBM40CP003, 90PBM81CP001, 90PBM82CP001	
	2	Service		ACROSS SODIUM HYPOCHLORITE STRAINER	
	3	Location		Field	
	4	QTY		2	
	5	TYPE		Diff. Pressure gauge with diaphragm seal unit	
PROCESS CONDITIONS	6	DUTY		CONTINUOUS	
	7	FLUID HANDLED		SEA WATER	
	8	SPEC. GRAVITY		1.02	
	9	TEMPERATURE	Deg C	25 ~ 32	
	10	PRESSURE	Bar	1 - 2	
	11	DESIGN TEMPERATURE	Deg C	50	
	12	DESIGN PRESSURE	Bar	5	
	13	HUMIDITY	%	5 ~ 100	
PROCESS CONNECTION AND CASE	14	Case type		Dry case	
	15	Case style		Manufacturer standard	
	16	Gauge size		150mm	
	17	Process connection size		1/2 " NPT M	
	18	Process connection location		Bottom Entry	
	19	Case pressure relief type		Rubber Blow out disc	
	20	Ring style		Bayonet Bezel	
	21	Mounting type		2" PIPE MOUNTING	
	22	Case material		SS304 with bayonet benzel	
	23	Window material		Shatterproof glass	
PRESSURE ELEMENT AND MOVEMENT	24	Elastic element type		SS316	
	25	Nom accuracy grade		± 2% FSD for 10% to 90% of measuring span	
	26	Element Material		SS316	
	27	Movement material		SS304	
DIAL AND POINTER	28	Dial scale type		single scale	
	29	Zero adjustment		Yes - micrometer Pointer	
	30	Graduations and color		White background , black markings	
	31	Scale range type	Bar	0 to 1	
	32	Dial material		Aluminium	
DIAPHRAGM SEALS / ISOLATOR	33	Seal type		Diaphragm seal	
	34	Process conn typ | Style		1/2 "NPT (M)threaded	
	35	Instr conn nom size		1/2 "	
	36	Diaphragm material		Monel	
	37	Bolting material		SS316	
	38	Upper housing material		SS316	
	39	Lower housing material		Monel	
	40	Fill fluid material		SILICONE OIL	
MAKE	41	GOA THERMOSTATIC			
MODEL	42	DPG110# Series D-BL-B-PM-6-S4-S6-S6-S4-Range-SU11-5M-Mo-S6-Mo-3N(1/2"NPTM)-Op0			
ACCESSORIES	Armoured capillary shall be provided of length 5 Meter in SS316				
	mounting bracket				

PROJECT :	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS		ELECTRO CHLORINATION SYSTEM		
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED		TECHNICAL DATASHEET OF DIFF. PRESSURE GAUGE		
BIDDER / VENDOR	DE NORA INDIA LIMITED		BHEL DOC. No. : PE-V11-412-174-A115		Rev
GENERAL	1	Tag Number		90PBM31CP001, 90PBM32CP001	
	2	Service		ACROSS ELECTROLYSER	
	3	Location		Field	
	4	QTY		2	
	5	TYPE		Diff. Pressure gauge with diaphragm seal unit	
PROCESS CONDITIONS	6	DUTY		CONTINUOUS	
	7	FLUID HANDLED		SEA WATER	
	8	SPEC. GRAVITY		1.02	
	9	TEMPERATURE	Deg C	25 ~ 32	
	10	PRESSURE	Bar	1 - 2	
	11	DESIGN TEMPERATURE	Deg C	50	
	12	DESIGN PRESSURE	Bar	5	
	13	HUMIDITY	%	5 ~ 100	
PROCESS CONNECTION AND CASE	14	Case type		Dry case	
	15	Case style		Manufacturer standard	
	16	Gauge size		150mm	
	17	Process connection size		1/2 " NPT M	
	18	Process connection location		Bottom Entry	
	19	Case pressure relief type		Rubber Blow out disc	
	20	Ring style		Bayonet Bezel	
	21	Mounting type		2" PIPE MOUNTING	
	22	Case material		DIE CAST ALLUMINIUM with epoxy Coating	
	23	Window material		Shatterproof glass	
PRESSURE ELEMENT AND MOVEMENT	24	Elastic element type		SS316	
	25	Nom accuracy grade		± 2% FSD for 10% to 90% of measuring span	
	26	Element Material		SS316	
	27	Movement material		SS304	
DIAL AND POINTER	28	Dial scale type		single scale	
	29	Zero adjustment		Yes - micrometer Pointer	
	30	Graduations and color		White background , black markings	
	31	Scale range type	Bar	0 to 1	
	32	Dial material		Aluminium	
DIAPHRAGM SEALS / ISOLATOR	33	Seal type		Diaphragm seal	
	34	Process conn typ | Style		1/2 "NPT (M)threaded	
	35	Instr conn nom size		1/2 "	
	36	Diaphragm material		Monel	
	37	Bolting material		SS316	
	38	Upper housing material		SS316	
	39	Lower housing material		Monel	
	40	Fill fluid material		SILICONE OIL	
MAKE	41	GOA THERMOSTATIC			
MODEL	42	DPG110# Series D-BL-B-PM-6-S4-S6-S6-S4-Range-SU11-5M-Mo-S6-Mo-3N(1/2"NPTM)-Op0			
ACCESSORIES	Armoured capillary shall be provided of length 5 Meter in SS316				
	mounting bracket				

PROJECT:	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS			ELECTRO CHLORINATION SYSTEM	
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED			TECHNICAL DATASHEET OF PRESSURE GAUGE	
BIDDER / VENDOR	DE NORA INDIA LIMITED			BHEL DOC. No. : PE-V11-412-174-A115	REV
GENERAL	1	Tag Number		90PBM81 P501,90PBM82CP501	
	2	Service		DISCHARGE OF DOSING PUMP AT SEA WATER INTAKE	
	3	Location		Field	
	4	QTY		2	
	5	TYPE		Pressure gauge with chemical seal unit	
PROCESS CONDITIONS	6	DUTY		CONTINUOUS	
	7	FLUID HANDLED		SEA WATER + HYPOCHLORITE	
	8	SPEC. GRAVITY		1.02	
	9	TEMPERATURE	Deg C	25 ~ 37	
	10	PRESSURE	Kg/cm2	3.2	
	11	DESIGN TEMPERATURE	Deg C	50	
	12	DESIGN PRESSURE	Kg/cm2	5	
	13	FLOW RATE	m3/h	12	
	14	HUMIDITY	%	5 ~ 100	
PROCESS CONNECTION AND CASE	15	Case type		Dry	
	16	Gauge size		150mm	
	17	Process connection size		1/2 " NPT M	
	18	Process connection location		Bottom	
	19	Case pressure relief type		Blow out disc at the back	
	20	Ring style		Bayonet Bezel	
	21	Mounting type		2" Pipe Mounting	
	22	Case material		SS316	
	23	Window material		Shatterproof glass	
PRESSURE ELEMENT AND MOVEMENT	24	Elastic element type		SS316	
	25	Nom accuracy grade		±1 % for Measuring span	
	26	Element Connection		Tig Welding	
	27	Movement material		SS3l6	
DIAL AND POINTER	28	Dial scale type		single scale	
	29	Zero adjustment		Yes - micrometer Pointer	
	30	Graduations and color		White background , black markings	
	31	Scale range type	Kg/cm2	0 - 6 Kg/cm2	
	32	Over range protection		130% of full scale	
	33	Dial material		Aluminum	
DIAPHRAGM SEALS / ISOLATOR	34	Seal type		Diaphragm seal	
	35	Process conn typ | Style		I/2"NPT (M)threaded '	
	36	Instr conn nom size		1/2 "	
	37	Diaphragm material		Monel	
	38	Bolting material		SS316	
	39	Upper housing material		Monel	
	40	Lower housing material		Monel	
	41	Fill fluid material		SILICONE OIL	
MAKE/ MODEL	42	GOA THERMOSTATIC			
	43	PG110W# Series P~B~B~2-6~S6~S6~S6~S6~Range~SUll~5M~Mo~Mo~Mo~3N			
ACCESSORIES	Armoured capillary shall be provided of lenghth 5 Meter in SS316				
	mounting bracket				

PROJECT:	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS			ELECTRO CHLORINATION SYSTEM	
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED			TECHNICAL DATASHEET OF PRESSURE GAUGE	
BIDDER / VENDOR	DE NORA INDIA LIMITED			BHEL DOC. No. : PE-V11-412-174-A115	REV
GENERAL	1	Tag Number		90PBM47CP501, 90PBM48CP501, 90PBM49CP501, 90PBM50CP501	
	2	Service		HYDROGEN DILUTION AIR BLOWER DISCHARGE	
	3	Location		Field	
	4	QTY		4	
	5	TYPE		DIAPHRAGM SENSING PRESSURE GAUGE	
PROCESS CONDITIONS	6	DUTY		CONTINUOUS	
	7	FLUID HANDLED		AIR	
	8	SPEC. GRAVITY		1	
	9	TEMPERATURE	Deg C	AMB	
	10	PRESSURE	mmWC	200	
	11	DESIGN TEMPERATURE	Deg C	50	
	12	DESIGN PRESSURE	Kg/cm2	5	
	13	FLOW RATE	Nm3/Hr	7700	
	14	HUMIDITY	%	5 ~ 100	
PROCESS CONNECTION AND CASE	15	Case Type		Dry	
	16	Gauge size		150mm	
	17	Process connection size		1/2 " NPT M	
	18	Process connection location		BOTTOM	
	19	Case pressure relief type		Blow out disc at the back	
	20	Ring style		Bayonet Bezel	
	21	Mounting type		Local Mounting	
	22	Case material		SS316	
	23	Window material		Shatterproof glass	
PRESSURE ELEMENT AND MOVEMENT	24	Elastic element type		N.A	
	25	Nom accuracy grade		±1.5 % for 10% to 90% of Measuring span	
	26	Element Material		N.A	
	27	Movement material		SS3I6	
DIAL AND POINTER	28	Dial scale type		single scale	
	29	Zero adjustment		Yes - micrometer Pointer	
	30	Graduations and color		White background , black markings	
	31	Scale range type	mmWC	0-400	
	32	Over range protection		130% of full scale	
	33	Dial material		Aluminum	
DIAPHRAGM SEALS / ISOLATOR	34	Process conn typ | Style		I /2 "NPT (M)threaded	
	35	Instr conn nom size		1/2 "	
	36	Diaphragm material		SS 316	
	37	Capillary-armor matl		N.A	
	38	Bolting material		SS304	
	39	Upper housing material		SS316	
	40	Lower housing material		SS316	
	41	Fill fluid material		N.A	
MAKE/ MODEL	42	GOA THERMOSTATIC			
	43	PG140# Series P~D~B~I~6~S6~S6~S6~S6~Range~S6~S6~3N~Op(See Column)			

PROJECT:	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS			ELECTRO CHLORINATION SYSTEM	
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED			TECHNICAL DATASHEET OF PRESSURE GAUGE	
BIDDER / VENDOR	DE NORA INDIA LIMITED			BHEL DOC. No. : PE-V11-412-174-A115	REV
GENERAL	1	Tag Number		90PBM90CP501	
	2	Service		inlet of chlorine analyser	
	3	Location		Field	
	4	QTY		1	
	5	TYPE		DIAPHRAGM Seal PRESSURE GAUGE	
PROCESS CONDITIONS	6	DUTY		CONTINUOUS	
	7	FLUID HANDLED		SEA WATER	
	8	SPEC. GRAVITY		1.02	
	9	TEMPERATURE	Deg C	25 ~ 32	
	10	PRESSURE	Kg/cm2	2.5	
	11	DESIGN TEMPERATURE	Deg C	50	
	12	DESIGN PRESSURE	Kg/cm2	5	
	13	FLOW RATE	l/hr	50	
	14	HUMIDITY	%	5 ~ 100	
PROCESS CONNECTION AND CASE	15	Case type		Dry	
	16	Gauge size		150mm	
	17	Process connection size		1/2 " NPT M	
	18	Process connection location		Bottom	
	19	Case pressure relief type		Blow out disc at the back	
	20	Ring style		Bayonet Bezel	
	21	Mounting type		2" Pipe Mounting	
	22	Case material		SS316	
	23	Window material		Shatterproof glass	
PRESSURE ELEMENT AND MOVEMENT	24	Elastic element type		SS3I6	
	25	Nom accuracy grade		±1 % for Measuring span	
	26	Element Connection		Tig Welding	
	27	Movement material		SS3I6	
DIAL AND POINTER	28	Dial scale type		single scale	
	29	Zero adjustment		Yes - micrometer Pointer	
	30	Graduations and color		White background , black markings	
	31	Scale range type	Kg/cm2	0-6 Kg/cm2	
	32	Over range protection		130% of full scale	
	33	Dial material		Aluminum	
DIAPHRAGM SEALS / ISOLATOR	34	Seal type		Diaphragm seal	
	35	Process conn typ | Style		I/2"NPT (M)threaded '	
	36	Instr conn nom size		1/2 "	
	37	Diaphragm material		Monel	
	38	Bolting material		SS316	
	39	Upper housing material		Monel	
	40	Lower housing material		Monel	
	41	Fill fluid material		SILICONE OIL	
MAKE/ MODEL	42	GOA THERMOSTATIC			
	43	PG110W# Series P~B~B~2-6~S6~S6~S6~S6~Range~SUll~5M~Mo~Mo~Mo~3N			
ACCESSORIES	Armoured capillary shall be provided of lenghth 5 Meter in SS316				
	mounting bracket				

PROJECT:	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS			ELECTRO CHLORINATION SYSTEM	
PRINCIPAL CONTRACTOR:	BHARAT HEAVY ELECTRICALS LIMITED			TECHNICAL DATASHEET OF PRESSURE GAUGE	
BIDDER/VENDOR	DE NORA INDIA LIMITED			BHEL DOC. No. : PE-V11 -412-174-A115	REV
GENERAL	I	Tag Number		90PBM6I CP501,90PBM62CP50I,	
	2	Service		NEUTRALISED EFFLUENT TRANSFER PUMP DISCHARGE	
	3	Location		Field	
	4	QTY		2	
	5	TYPE		Pressure gauge with chemical seal unit	
PROCESS CONDITIONS	6	DUTY		CONTINUOUS	
	7	FLUID HANDLED		SEA WATER	
	8	SPEC. GRAVITY		1.02	
	9	TEMPERATURE	Deg C	25-32	
	10	PRESSURE	Kg/cm2	2	
	11	DESIGN TEMPERATURE	Deg C	50	
	12	DESIGN PRESSURE	Kg/cm2	5	
	13	FLOW RATE	m3/h	2	
	14	HUMIDITY	%	5-100	
PROCESS CONNECTION AND CASE	15	Case type		Dry	
	16	Gauge size		150mm	
	17	Process connection size		1/2" NPT M	
	18	Process connection location		Bottom	
	19	Case pressure relief type		Blow out disc at the back	
	20	Ring style		Bayonet Bezel	
	21	Mounting type		2" Pipe Mounting	
	22	Case material		SS3I6	
	23	Window material		Shatterproof glass	
PRESSURE ELEMENT AND MOVEMENT	24	Elastic element type		SS3I6	
	25	Nom accuracy grade		±1 % for Measuring span	
	26	Element Connection		Tig Welding	
	27	Movement material		SS3I6	
DIAL AND POINTER	28	Dial scale type		single scale	
	29	Zero adjustment		Yes - micrometer Pointer	
	30	Graduations and color		White background , black markings	
	31	Scale range type	Kg/cm2	0-4 Kg/cm2	
	32	Over range protection		130% of full scale	
	33	Dial material		Aluminum	
DIAPHRAGM SEALS/ ISOLATOR	34	Seal type		Diaphragm seal	
	35	Process conn type | Style		1/2" NPT (Mjthreaded	
	36	Instr conn nom size		1/2"	
	37	Diaphragm material		Monel	
	38	Bolting material		SS304	
	39	Upper housing material		Monel	
	40	Lower housing material		Monel	
	41	Fill fluid material		SILICONE OIL	
MAKE MODEL	42	GOA THERMOSTATIC			
	43	PG110W# Series P~B~B~2-6~S6~S6~S6~S6~Range~SUll~5M~Mo~Mo~Mo~3N			
ACCESSORIES	Armoured capillary shall be provided of lenghth 5 Meter in SS316				
	mounting bracket				

PROJECT:	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS			ELECTRO CHLORINATION SYSTEM	
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED			TECHNICAL DATASHEET OF PRESSURE GAUGE	
BIDDER / VENDOR	DE NORA INDIA LIMITED			BHEL DOC. No. : PE-V11-412-174-A115	REV
GENERAL	1	Tag Number		90PBM51 CP501,90PBM52CP501	
	2	Service		HYDROCHLORIC ACID UNLOADING PUMP DISCHARGE	
	3	Location		Field	
	4	QTY		2	
	5	TYPE		Pressure gauge with chemical seal unit	
PROCESS CONDITIONS	6	DUTY		CONTINUOUS	
	7	FLUID HANDLED		33% HYDROCHLORIC ACID	
	8	SPEC. GRAVITY		1.02	
	9	TEMPERATURE	Deg C	25 ~ 35	
	10	PRESSURE	Kg/cm2	1.5	
	11	DESIGN TEMPERATURE	Deg C	50	
	12	DESIGN PRESSURE	Kg/cm2	5	
	13	FLOW RATE	m3/h	10	
	14	HUMIDITY	%	5 ~ 100	
PROCESS CONNECTION AND CASE	15	Case type		Dry	
	16	Gauge size		150mm	
	17	Process connection size		1/2 " NPT M	
	18	Process connection location		Bottom	
	19	Case pressure relief type		Blow out disc at the back	
	20	Ring style		Bayonet Bezel	
	21	Mounting type		2" Pipe Mounting	
	22	Case material		SS316	
	23	Window material		Shatterproof glass	
PRESSURE ELEMENT AND MOVEMENT	24	Elastic element type		SS316	
	25	Nom accuracy grade		±1 % for Measuring span	
	26	Element Connection		Tig Welding	
	27	Movement material		SS3l6	
DIAL AND POINTER	28	Dial scale type		single scale	
	29	Zero adjustment		Yes - micrometer Pointer	
	30	Graduations and color		White background , black markings	
	31	Scale range type	Kg/cm2	0 - 2.5 Kg/cm2	
	32	Over range protection		130% of full scale	
	33	Dial material		Aluminum	
DIAPHRAGM SEALS / ISOLATOR	34	Seal type		Diaphragm seal	
	35	Process conn typ | Style		I/2"NPT (M)threaded '	
	36	Instr conn nom size		1/2 "	
	37	Diaphragm material		Hastalloy C	
	38	Bolting material		SS304	
	39	Upper housing material		Hastalloy C	
	40	Lower housing material		Hastalloy C	
	41	Fill fluid material		SILICONE OIL	
MAKE MODEL	42	GOA THERMOSTATIC			
	43	PG110W# Series P~B~B~2-6~S6~S6~S6~S6~S6~Range~SUll~5M~Hc~Hc~Hc~3N			
ACCESSORIES	Armoured capillary shall be provided of lenghth 5 Meter in SS316				
	mounting bracket				

PROJECT:	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS			ELECTRO CHLORINATION SYSTEM	
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED			TECHNICAL DATASHEET OF PRESSURE GAUGE	
BIDDER / VENDOR	DE NORA INDIA LIMITED			BHEL DOC. No. : PE-V11-412-174-A115	REV
GENERAL	1	Tag Number		90PBM21 CP501,90PBM22CP501	
	2	Service		SEAWATER BOOSTER PUMP DISCHARGE	
	3	Location		Field	
	4	QTY		2	
	5	TYPE		Pressure gauge with chemical seal unit	
PROCESS CONDITIONS	6	DUTY		CONTINUOUS	
	7	FLUID HANDLED		SEA WATER	
	8	SPEC. GRAVITY		1.02	
	9	TEMPERATURE	Deg C	25 ~ 32	
	10	PRESSURE	Kg/cm2	2.5	
	11	DESIGN TEMPERATURE	Deg C	50	
	12	DESIGN PRESSURE	Kg/cm2	5	
	13	FLOW RATE	m3/h	150	
	14	HUMIDITY	%	5 ~ 100	
PROCESS CONNECTION AND CASE	15	Case type		Dry	
	16	Gauge size		150mm	
	17	Process connection size		1/2 " NPT M	
	18	Process connection location		Bottom	
	19	Case pressure relief type		Blow out disc at the back	
	20	Ring style		Bayonet Bezel	
	21	Mounting type		2" Pipe Mounting	
	22	Case material		SS316	
	23	Window material		Shatterproof glass	
PRESSURE ELEMENT AND MOVEMENT	24	Elastic element type		SS316	
	25	Nom accuracy grade		±1 % for Measuring span	
	26	Element Connection		Tig Welding	
	27	Movement material		SS3I6	
DIAL AND POINTER	28	Dial scale type		single scale	
	29	Zero adjustment		Yes - micrometer Pointer	
	30	Graduations and color		White background , black markings	
	31	Scale range type	Kg/cm2	0 - 4 Kg/cm2	
	32	Over range protection		130% of full scale	
	33	Dial material		Aluminum	
DIAPHRAGM SEALS / ISOLATOR	34	Seal type		Diaphragm seal	
	35	Process conn typ | Style		1/2" NPT (M)threaded	
	36	Instr conn nom size		1/2 "	
	37	Diaphragm material		Monel	
	38	Bolting material		SS316	
	39	Upper housing material		Monel	
	40	Lower housing material		Monel	
	41	Fill fluid material		SILICONE OIL	
MAKE MODEL	42	GOA THERMOSTATIC			
	43	PG110W# Series P~B~B~2-6~S6~S6~S6~S6~Range~SUll~5M~Mo~Mo~Mo~3N			
ACCESSORIES	Armoured capillary shall be provided of length 5 Meter in SS316				
	mounting bracket				

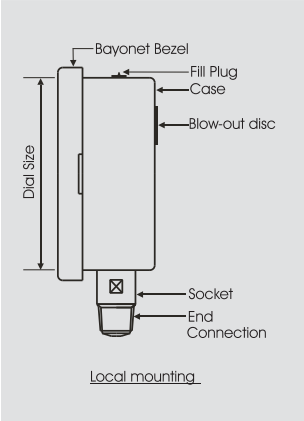
PROJECT:	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS			ELECTRO CHLORINATION SYSTEM	
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED			TECHNICAL DATASHEET OF PRESSURE GAUGE	
BIDDER / VENDOR	DE NORA INDIA LIMITED			BHEL DOC. No. : PE-V11-412-174-A115	REV
GENERAL	1	Tag Number		90PBM52CP501, 90PBM53CP501	
	2	Service		HYDROCHLORIC ACID CLEANING PUMP DISCHARGE	
	3	Location		Field	
	4	QTY		2	
	5	TYPE		Pressure gauge with chemical seal unit	
PROCESS CONDITIONS	6	DUTY		CONTINUOUS	
	7	FLUID HANDLED		DILUTED HYDROCHLORIC ACID	
	8	SPEC. GRAVITY		1.02	
	9	TEMPERATURE	Deg C	25 ~ 35	
	10	PRESSURE	Kg/cm2	2	
	11	DESIGN TEMPERATURE	Deg C	50	
	12	DESIGN PRESSURE	Kg/cm2	5	
	13	FLOW RATE	m3/h	41	
	14	HUMIDITY	%	5 ~ 100	
PROCESS CONNECTION AND CASE	15	Case type		Dry	
	16	Gauge size		150mm	
	17	Process connection size		1/2 " NPT M	
	18	Process connection location		Bottom	
	19	Case pressure relief type		Blow out disc at the back	
	20	Ring style		Bayonet Bezel	
	21	Mounting type		2" Pipe Mounting	
	22	Case material		SS316	
	23	Window material		Shatterproof glass	
PRESSURE ELEMENT AND MOVEMENT	24	Elastic element type		SS316	
	25	Nom accuracy grade		±1 % for Measuring span	
	26	Element Connection		Tig Welding	
	27	Movement material		SS3I6	
DIAL AND POINTER	28	Dial scale type		single scale	
	29	Zero adjustment		Yes - micrometer Pointer	
	30	Graduations and color		White background , black markings	
	31	Scale range type	Kg/cm2	0 - 4 Kg/cm2	
	32	Over range protection		130% of full scale	
	33	Dial material		Aluminum	
DIAPHRAGM SEALS / ISOLATOR	34	Seal type		Diaphragm seal	
	35	Process conn typ | Style		I/2"NPT (M)threaded '	
	36	Instr conn nom size		1/2 "	
	37	Diaphragm material		Hastalloy C	
	38	Bolting material		SS304	
	39	Upper housing material		Hastalloy C	
	40	Lower housing material		Hastalloy C	
	41	Fill fluid material		SILICONE OIL	
MAKE / MODEL	42	GOA THERMOSTATIC			
	43	PG110W# Series P~B~B~2-6~S6~S6~S6~S6~Range~SUll~5M~Hc~Hc~Hc~3N			
ACCESSORIES	Armoured capillary shall be provided of lenghth 5 Meter in SS316				
	mounting bracket				

PROJECT:	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS			ELECTRO CHLORINATION SYSTEM	
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED			TECHNICAL DATASHEET OF PRESSURE GAUGE	
BIDDER / VENDOR	DE NORA INDIA LIMITED			BHEL DOC. No. : PE-V11-412-174-A115	REV
GENERAL	1	Tag Number		90PBM41 CP501,90PBM42CP501	
	2	Service		CONTINOUS HYPO DOSING PUMP DISCHARGE	
	3	Location		Field	
	4	QTY		2	
	5	TYPE		Pressure gauge with chemical seal unit	
PROCESS CONDITIONS	6	DUTY		CONTINUOUS	
	7	FLUID HANDLED		SEA WATER + HYPOCHLORITE	
	8	SPEC. GRAVITY		1.02	
	9	TEMPERATURE	Deg C	25 ~ 37	
	10	PRESSURE	Kg/cm2	3.2	
	11	DESIGN TEMPERATURE	Deg C	50	
	12	DESIGN PRESSURE	Kg/cm2	5	
	13	FLOW RATE	m3/h	120	
	14	HUMIDITY	%	5 ~ 100	
PROCESS CONNECTION AND CASE	15	Case type		Dry	
	16	Gauge size		150mm	
	17	Process connection size		1/2 " NPT M	
	18	Process connection location		Bottom	
	19	Case pressure relief type		Blow out disc at the back	
	20	Ring style		Bayonet Bezel	
	21	Mounting type		2" Pipe Mounting	
	22	Case material		SS316	
	23	Window material		Shatterproof glass	
PRESSURE ELEMENT AND MOVEMENT	24	Elastic element type		SS316	
	25	Nom accuracy grade		±1 % for Measuring span	
	26	Element Connection		Tig Welding	
	27	Movement material		SS3l6	
DIAL AND POINTER	28	Dial scale type		single scale	
	29	Zero adjustment		Yes - micrometer Pointer	
	30	Graduations and color		White background , black markings	
	31	Scale range type	Kg/cm2	0 - 6 Kg/cm2	
	32	Over range protection		130% of full scale	
	33	Dial material		Aluminum	
DIAPHRAGM SEALS / ISOLATOR	34	Seal type		Diaphragm seal	
	35	Process conn typ | Style		I /2 "NPT (M)threaded	
	36	Instr conn nom size		1/2 "	
	37	Diaphragm material		Monel	
	38	Bolting material		SS316	
	39	Upper housing material		Monel	
	40	Lower housing material		Monel	
	41	Fill fluid material		SILICONE OIL	
MAKE / MODEL	42	GOA THERMOSTATIC			
	43	PG110W# Series P~B~B~2-6~S6~S6~S6~S6~Range~SUll~5M~Mo~Mo~Mo~3N			
ACCESSORIES	Armoured capillary shall be provided of lenghth 5 Meter in SS316				
	mounting bracket				

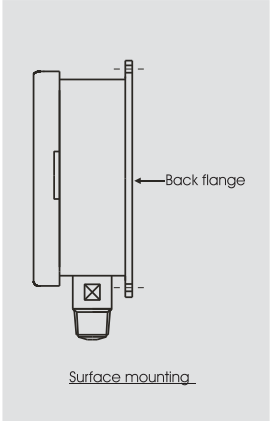
PROJECT:	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS			ELECTRO CHLORINATION SYSTEM	
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED			TECHNICAL DATASHEET OF PRESSURE GAUGE	
BIDDER / VENDOR	DE NORA INDIA LIMITED			BHEL DOC. No. : PE-V11-412-174-A115	REV
GENERAL	1	Tag Number		90PBM43CP501, 90PBM44CP501, 90PBM45CP501	
	2	Service		DISCHARGE OF SHOCK DOSING PUMP	
	3	Location		Field	
	4	QTY		3	
	5	TYPE		Pressure gauge with chemical seal unit	
PROCESS CONDITIONS	6	DUTY		CONTINUOUS	
	7	FLUID HANDLED		SEA WATER + HYPOCHLORITE	
	8	SPEC. GRAVITY		1.02	
	9	TEMPERATURE	Deg C	25 ~ 37	
	10	PRESSURE	Kg/cm2	3.2	
	11	DESIGN TEMPERATURE	Deg C	50	
	12	DESIGN PRESSURE	Kg/cm2	5	
	13	FLOW RATE	m3/h	120	
	14	HUMIDITY	%	5 ~ 100	
PROCESS CONNECTION AND CASE	15	Case type		Dry	
	16	Gauge size		150mm	
	17	Process connection size		1/2 " NPT M	
	18	Process connection location		Bottom	
	19	Case pressure relief type		Blow out disc at the back	
	20	Ring style		Bayonet Bezel	
	21	Mounting type		2" Pipe Mounting	
	22	Case material		SS316	
	23	Window material		Shatterproof glass	
PRESSURE ELEMENT AND MOVEMENT	24	Elastic element type		SS316	
	25	Nom accuracy grade		±1 % for Measuring span	
	26	Element Connection		Tig Welding	
	27	Movement material		SS3I6	
DIAL AND POINTER	28	Dial scale type		single scale	
	29	Zero adjustment		Yes - micrometer Pointer	
	30	Graduations and color		White background , black markings	
	31	Scale range type	Kg/cm2	0 - 6 Kg/cm2	
	32	Over range protection		130% of full scale	
	33	Dial material		Aluminum	
DIAPHRAGM SEALS / ISOLATOR	34	Seal type		Diaphragm seal	
	35	Process conn typ | Style		I/2"NPT (M)threaded '	
	36	Instr conn nom size		1/2 "	
	37	Diaphragm material		Monel	
	38	Bolting material		SS316	
	39	Upper housing material		Monel	
	40	Lower housing material		Monel	
	41	Fill fluid material		SILICONE OIL	
MAKE / MODEL	42	GOA THERMOSTATIC			
	43	PG110W# Series P~B~B~2-6~S6~S6~S6~S6~Range~SUll~5M~Mo~Mo~Mo~3N			
ACCESSORIES	Armoured capillary shall be provided of lenghth 5 Meter in SS316				
	mounting bracket				

PROJECT:	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS			ELECTRO CHLORINATION SYSTEM	
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED			TECHNICAL DATASHEET OF PRESSURE GAUGE	
BIDDER / VENDOR	DE NORA INDIA LIMITED			BHEL DOC. No. : PE-V11-412-174-A115	REV
GENERAL	1	Tag Number		90PBM46CP501, 90PBM47CP501	
	2	Service		DISCHARGE OF CONTINOUS DOSING PUMP AT PTP	
	3	Location		Field	
	4	QTY		2	
	5	TYPE		Pressure gauge with chemical seal unit	
PROCESS CONDITIONS	6	DUTY		CONTINUOUS	
	7	FLUID HANDLED		SEA WATER + HYPOCHLORITE	
	8	SPEC. GRAVITY		1.02	
	9	TEMPERATURE	Deg C	25 ~ 37	
	10	PRESSURE	Kg/cm2	3.2	
	11	DESIGN TEMPERATURE	Deg C	50	
	12	DESIGN PRESSURE	Kg/cm2	5	
	13	FLOW RATE	m3/h	9	
	14	HUMIDITY	%	5 ~ 100	
PROCESS CONNECTION AND CASE	15	Case type		Dry	
	16	Gauge size		150mm	
	17	Process connection size		1/2 " NPT M	
	18	Process connection location		Bottom	
	19	Case pressure relief type		Blow out disc at the back	
	20	Ring style		Bayonet Bezel	
	21	Mounting type		2" Pipe Mounting	
	22	Case material		SS316	
	23	Window material		Shatterproof glass	
PRESSURE ELEMENT AND MOVEMENT	24	Elastic element type		SS316	
	25	Nom accuracy grade		±1 % for Measuring span	
	26	Element Connection		Tig Welding	
	27	Movement material		SS3I6	
DIAL AND POINTER	28	Dial scale type		single scale	
	29	Zero adjustment		Yes - micrometer Pointer	
	30	Graduations and color		White background , black markings	
	31	Scale range type	Kg/cm2	0 - 6 Kg/cm2	
	32	Over range protection		130% of full scale	
	33	Dial material		Aluminum	
DIAPHRAGM SEALS / ISOLATOR	34	Seal type		Diaphragm seal	
	35	Process conn typ | Style		I/2"NPT (M)threaded '	
	36	Instr conn nom size		1/2 "	
	37	Diaphragm material		Monel	
	38	Bolting material		SS316	
	39	Upper housing material		Monel	
	40	Lower housing material		Monel	
	41	Fill fluid material		SILICONE OIL	
MAKE / MODEL	42	GOA THERMOSTATIC			
	43	PG110W# Series P~B~B~2-6~S6~S6~S6~S6~Range~SUll~5M~Mo~Mo~Mo~3N			
ACCESSORIES	Armoured capillary shall be provided of lenghth 5 Meter in SS316				
	mounting bracket				

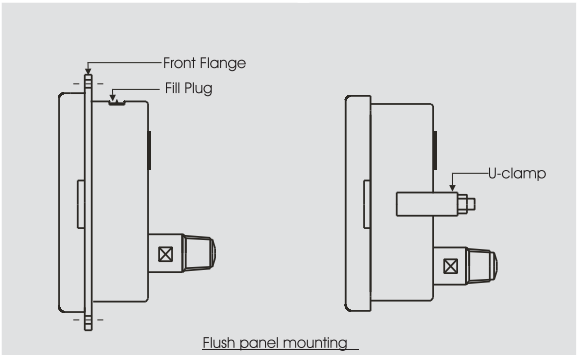
PG100# Series Bourdon Sensing Pressure Gauges



Local mounting



Surface mounting



Flush panel mounting

Features

- "All Stainless Steel" socket welded to case construction
- Weather-proof casing to IP:66, IS:13947
- Shatter-proof glass as a standard
- Micro-gear pointer for zero re-set.
- Blow out disc at the rear of the case.
- Dry and Liquid Filled versions

Performance

- Pressure measurement upto 1000 bar.
- Accuracy ±1% of full span and over pressure protection 1.3 x full span.
- Type Approval for "Endurance" and "Shock" tests obtained

Pressure Gauges manufactured by us are designed for use in process industries which demand consistent performance and longevity.
All Stainless Steel and welded construction can resist the most severe operating conditions created by environment as well as process media. Micro-gear pointer & blow out disc provided as a standard feature for dry gauges.
Pressure Gauges are filled with dampening fluids to prevent damage due to vibration, when the gauge is mounted on equipment with severe vibrations and high pulsations.
Pressure gauges can be supplied with coil/pig tail syphons for use on steam service and pulsation dampners (snubbers) for use on pulsating services.
Wherever the max. operating pressure exceeds the overpressure limit of the gauge, these are supplied along with gauge savers.

Code	Gauge Type
P	Pressure Gauge

Code	Sensing Element
B	Bourdon

Code	Socket Entry
B	Bottom
R	Off Centre Back

Code	Mounting
1	Local mounting
2	Back flange for surface mounting
3	U-clamp for flush panel mounting
4	Front flange for flush panel mounting

Code	Dial Size (mm)
2.5	63
4	100
6	150

Code	Case Material
S4	SS304
S6	SS316

Code	Option
Define	Select from table 4

Code	End Connection
1N	1/4"NPT(M)
2N	3/8"NPT(M)
3N	1/2"NPT(M)
4N	3/4"NPT(M)
1B	1/2"BSP(M)
2B	3/4"BSP(M)
OT	Other, please specify

Code	Range
Define	Select Standard Ranges from table 1

Code	Movement Material
S4	SS304

Code	Socket Material
S6/S6L	SS316 / SS316L
Mo4	Monel

Code	Bourdon Material
S6/S6L	SS316 / SS316L
Mo4	Monel
OT	Other, please specify

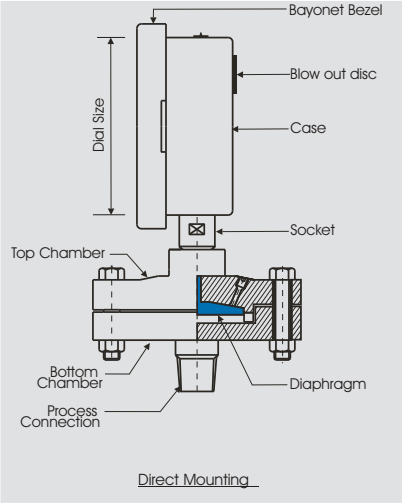
PG 100# SERIES

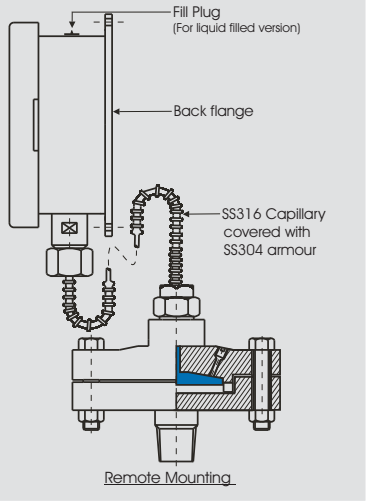
ORDERING EXAMPLE

PG100# Series P-B-B-1-4-S4-S6-S4-S4-0/16-3N-Op0

GOA THERMOSTATIC INSTRUMENTS PVT. LTD.
Office: Flat B, Ground Floor, Hill Crown Apt., College Road, Mapusa - 403 507, Tel: 0832-2252719, Fax:0832-2263294 E-mail: pyroadmin@pyro-electric.in
Visit us at www.pyro-electric.in

PG110# Series Pressure Gauges with chemical seal unit and threaded process connection.





Features

- All Stainless Steel construction
- Welded diaphragm design
- Weather-proof casing to IP:66, IS:13947
- Integral and remote seal designs
- Dry and Filled versions
- Seal fluid options to suit process fluids

Performance

- Accuracy ±1% of full span and over pressure protection 1.3 x full span.

Diaphragm Seals are provided to isolate the sensing element of pressure gauge from process fluids which are corrosive, viscous, sedimentous or high temperature fluids.
The diaphragm is welded to the top chamber and leak proof tested to ensure separation of filling fluid from the process fluid. A flushing ring can also be provided for cleaning or purging the seal without its removal from the process.
Wetted part materials can be selected to suit practically all applications.

Code	Gauge Type
P	Pressure Gauge

Code	Sensing Element
B	Bourdon

Code	Socket Entry
B	Bottom

Code	Mounting
1	Local mounting
2	Back flange for remote mounting

Code	Dial Size (mm)
4	100
6	150

Code	Case Material
S4	SS304
S6	SS316

Code	Sensing Element Mat'l
S6/S6L	SS316 / SS316L
S6Ti	SS316,Ti stabilized

Code	Socket Material
S6/S6L	SS316 / SS316L

Code	Movement Material
S4	SS304

Code	Range
Define	Select standard ranges from Table 1

Code	Option
Define	Select from table 4

Code	Process Connection
3N	1/2"NPT(M)
4N	3/4"NPT(M)
1B	1/2"BSP(M)
2B	3/4"BSP(M)
OT	Other, please specify

Code	Bottom chamber
S6/S6L	Ss316 / SS316L
S6(P)	SS316 lined with PTFE
OT	Other, please specify

Code	Top chamber Material
S4	SS304
S6	SS316

Code	Diaphragm Material
S6/S6L	SS316 / SS316L
S6(P)	SS316 lined with PTFE
Hc	Hastelloy C
Mo	Monel
OT	Other, please specify

Code	Capillary length
2M	Define; eg 2000mm
XX	None

Code	Diaphragm seal unit
SU11	Seal unit with threaded process connection (Add suffix R for remote seal unit)

PG 110# SERIES

ORDERING EXAMPLE

PG110# Series P-B-B-1-4-S4-S6-S6-S4-0/25-SU11-2M-S6-S4-S6-3N-Op0

GOA THERMOSTATIC INSTRUMENTS PVT. LTD.
Office: Flat B, Ground Floor, Hill Crown Apt., College Road, Mapusa - 403 507, Tel: 0832-2252719, Fax:0832-2263294 E-mail: pyroadmin@pyro-electric.in
Visit us at www.pyro-electric.in

PROJECT :	2 x 660MW ENNORE SEZ COAL BASED STPP at Ash Dyke of NCTPS		ELECTRO CHLORINATION SYSTEM		
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED		TECHNICAL DATASHEET FOR CHLORINE ANALYSER		
BIDDER / VENDOR	DE NORA INDIA LIMITED		BHEL DOC. No. : PE-V11-412-174-A115		Rev
GENERAL	1	Tag No.		90PBM90CQ001	
	2	Quantity		1	
	3	Service		DISCHARGE OF PUMP AT CW FORBAY	
	4	Type		RESIDUAL CHLORINE ANALYSER	
PROCESS CONDITIONS	5	Duty		CONTINUOUS	
	6	Fluid		SEAWATER	
	7	Specific Gravity		1.022	
	8	Operating Pressure	Kg/Cm2	2	
	9	Operating Temperature	Deg. C	25 ~ 32	
	10	Humidity	%	5 ~ 100	
SENSOR SPECIFICATIONS	11	Type		Amperometric	
	12	sensor Material		Gold , Noryl(1), (PPO), Viton, EPDM, Silicone	
	13	Range		0 to 10.0 mg / L (ppm)	
	14	Accuracy		Accuracy depends on the accuracy of the chemical test used to calibrate the sensor.	
	15	Response Time		22 Seconds to 95% of final reading at 25 Deg C	
	16	Sensor end connection size		1 in. NPT Male	
	17	Sensor Integral Cable length		25 ft cable	
	18	Sample Flow Rate	L/Hr	30 - 57	
	19	Sensor Maximum Temp. Capacity	Deg. C	0-50 °C	
	20	Working pressure	psig	65	
	21	Sample drain		Yes	
TRANSMITTER SPECIFICATIONS	22	Mounting		Pipe/ Panel mounted	
	23	Housing Material		Polycarbonate Type 4X,	
	24	Protection Class		IP65	
	25	Power Supply		85 - 265 V AC, 50 - 60 Hz, 1 Phase	
	26	Dimension		(155 mm x 155 mm x 131 mm)	
	27	Ambient Temperature Limit	Deg. C	0 - 50	
	28	Inputs		Single sensor	
	29	Outputs		4 - 20mA analog	
	30	Display Type / Unit		LCD / PPM	
	31	Calibration		Automatic	
MISCELLANEOUS	32	Chlorine Sensor Model No		499ACL-01-54	
	33	Analyzer Model No		1056-03-24-38-AN	
	34	Make		Emerson process management	
Accessories	Pipe/Panel mounting Kit				
	SS tag Plate				
	low flow panel				

Rosemount 1056 Dual Channel Transmitter

Multi-parameter Transmitter for Liquid Analysis

The Rosemount 1056 Dual Channel Transmitter displays up to two independent liquid analytical measurements. HART and Profibus DP digital communication options allow for connection to HART hosts and Profibus networks. Start-up and installation of the 1056 is easy by using Quick Start Programming.

Overview

Independent Dual Input Measurements

- Expandable to two channels of liquid analytical measurements: pH/ORP, Conductivity, Free Chlorine, Total Chlorine, Dissolved Oxygen, Ozone, and Turbidity.
- Modular boards with auto-recognition of sensor board.
- Large, easy to read, user customizable display of dual measurements in addition to diagnostic and temperature readings.

Reduced Installation and Maintenance Time

- Shorter installation times using Quick Start programming at initial install or after factory reset.
- Effortlessly connect with PLCs and DCS' by choosing the HART or Profibus DP communication options.
- Display measurements, configure alarms, and conduct maintenance with a simple to use local operator interface.
- Efficiently manage your devices using intuitive device dashboards on AMS/475 Communicators.

Accurate, Linear and Reliable Measurements of Analytical Sensors

- Faster calibration of pH sensors using auto pH Buffer solution detection.
- Linear conductivity measurements with on-board concentration curves for common acids and bases.
- Built-in features to easily display accurate amperometric and turbidity measurements.

Contents

1056 Dual Channel Transmitter

Rosemount 1056 Dual Channel Transmitter is a line powered device that can accept inputs from pH/ORP, ISE, flow, conductivity (contacting and toroidal), turbidity, and amperometric (dissolved oxygen, chlorine, and ozone) sensors.

- Faster installation using Quick Start programming, auto-recognition of sensor boards and modular design.
- At a glance view of pertinent information provided by the large customizable display.
- Visibility of process parameters by utilizing HART or Profibus DP digital communications.

Additional Information

Specifications: see "Specifications" on page 5
Certifications: see "Product Certifications" on page 6
Dimensional drawings: see "Dimensional Drawings" on page 7

Table 1. Rosemount 1056 Dual Channel Transmitter Ordering Information

Model	Transmitter type
1056	Dual channel transmitter
Power	
01	115/230 Vac, 50/60 Hz no relays (1)
02	24 Vdc with four alarm relays
03	85-265 Vac switching, 50/60 Hz with four alarm relays
Measurement 1	
20	Contacting conductivity
21	Toroidal conductivity
22	pH/ORP/ISE
23	Flow/current input
24	Chlorine
25	Dissolved oxygen
26	Ozone
27	Turbidity
Measurement 2	
30	Contacting conductivity
31	Toroidal conductivity
32	pH/ORP/ISE
33	Flow/current input
34	Chlorine
35	Dissolved oxygen

Table 1. Rosemount 1056 Dual Channel Transmitter Ordering Information(continued)

36	Ozone
37	Turbidity
38	None
Communication	
AN	4-20 mA analog
DP	Profibus DP digital communication
HT	HART® digital communication
UL Approval	
-	CSA/FM approval
UL	UL approval

1. Not compatible with Turbidity Measurements.

Table 2. Rosemount 1056 Dual Channel Transmitter Accessories List

Part Number	Description
23554-00	Cable gland kit (Qty 5)
23820-00	2 in. pipe mounting kit (Includes U-bolts, mounting bracket, nuts, washers, and screws)
23820-01	2 in. stainless steel pipe mounting kit (Includes U-bolts, mounting bracket, nuts, washers and screws)
9240048-00	Stainless steel tag (customer specified marking)

Specifications

General Analyzer

Enclosure

Material: Polycarbonate.

Rating: Type 4X and IP65.

Dimensions: 6.10 in. L x 6.10 in. W x 5.45 in. H
(155 mm x 155 mm x 131 mm)

Conduit openings: 1/2 in. or PG 13.5 conduit fittings.

Display

Features: User customizable, monochromatic graphic liquid crystal, back lit display.

Display Resolution: 128 x 96 pixel display resolution.

Dimensions: 3.8 in. (Diagonal)

Ambient Conditions

Temperature: 32 to 131 °F (0 to 55 °C)

Temperature for Turbidity: 32 to 122 °F (0 to 50 °C)

Relative Humidity: 5 to 95% (non-condensing)

Storage Temperature: -4 to 140 °F (-20 to 60 °C)

Power

01: 115 Vac ±15% 60 Hz ±6%, 10 W;
230 Vac ±15% 50 Hz ±6%, 10 W.

02: 20 to 30 Vdc. 15 W.

03: 84 to 265 Vac, 47 to 63.0 Hz. 15 W.

Power option codes 02 and 03 include four programmable relays.

Equipment protected by double insulation.

Relays

Form C, SPDT, epoxy sealed

Maximum Relay Current	
	Resistive
28 Vdc	5.0 A
115 Vac	5.0 A
230 Vac	5.0 A

Inductive Load: 1/8 HP motor (maximum) at 115/230 Vac

*Relays only available with option 02 power supply (20 - 30 Vdc) or 03 switching power supply (84 - 265 Vac)

Alarm Relays

Four configurable alarm relays for process measurement as alarms or faults with interval timer settings.

Terminal Wire Sizes

Power: 24-12 AWG

Analog outputs: 26-16 AWG

Relays: 24-12 AWG

Weight/Shipping Weight (rounded to nearest 1 lb. or 0.5 kg)

3 lb./4 lb. (1.5 kg/2.0 kg)

Product Certifications

Hazardous Location Approvals (Not available for DP)

Class I, Division 2, Group A, B, C, and D

Class II, Division 2, Groups E, F, and G

Class III T4A Tamb = 50 °C

Evaluated to the ANSI/UL Standards. The 'C' and 'US' indicators adjacent to the CSA Mark signify that the product has been evaluated to the applicable CSA and ANSI/UL Standards, for use in Canada and the U.S. respectively.

Class I, Division 2, Group A, B, C, and D

Class II and III, Division 2, Groups E, F, and G

T4A Tamb = 50 °C, Enclosure Type 4X

Ordinary Locations: (only with UL ordering option)

Pollution Degree 2

Normally only non-conductive pollution occurs. Temporary conductivity caused by condensation possible.
Altitude: 6562 ft. (2000 meter) maximum

Radio Frequency Immunity/Electromagnetic Interference (RFI/EMI)

EN-61326

Low Voltage Directive (LVD)

CE

EN-61010-1

European Directive Information

A copy of the EC Declaration of Conformity can be found at the end of the Quick Start Guide and the User's Manual. The most recent revision of the EC Declaration of Conformity can be found at www.Emerson.com/RosemountLiquidAnalysis.

Dimensional Drawings

Figure 1. Panel Mount Dimensions

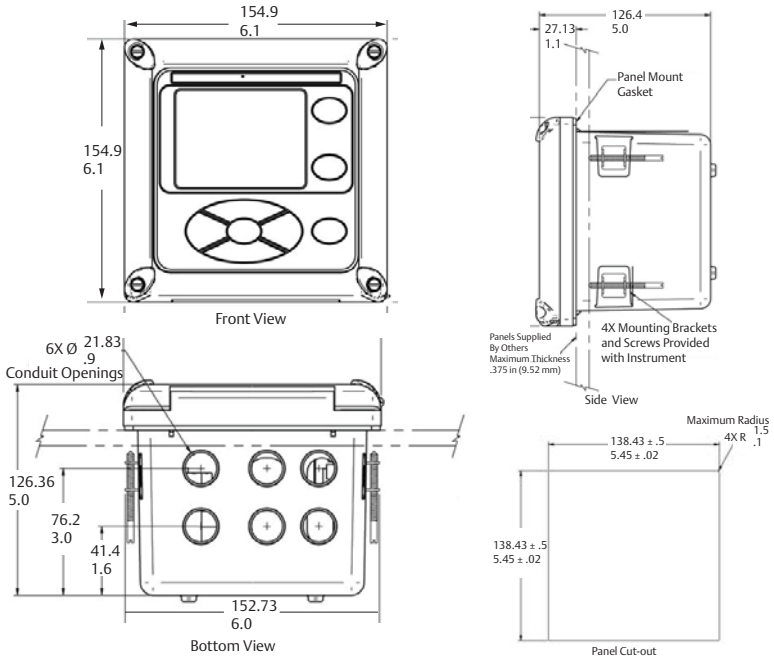
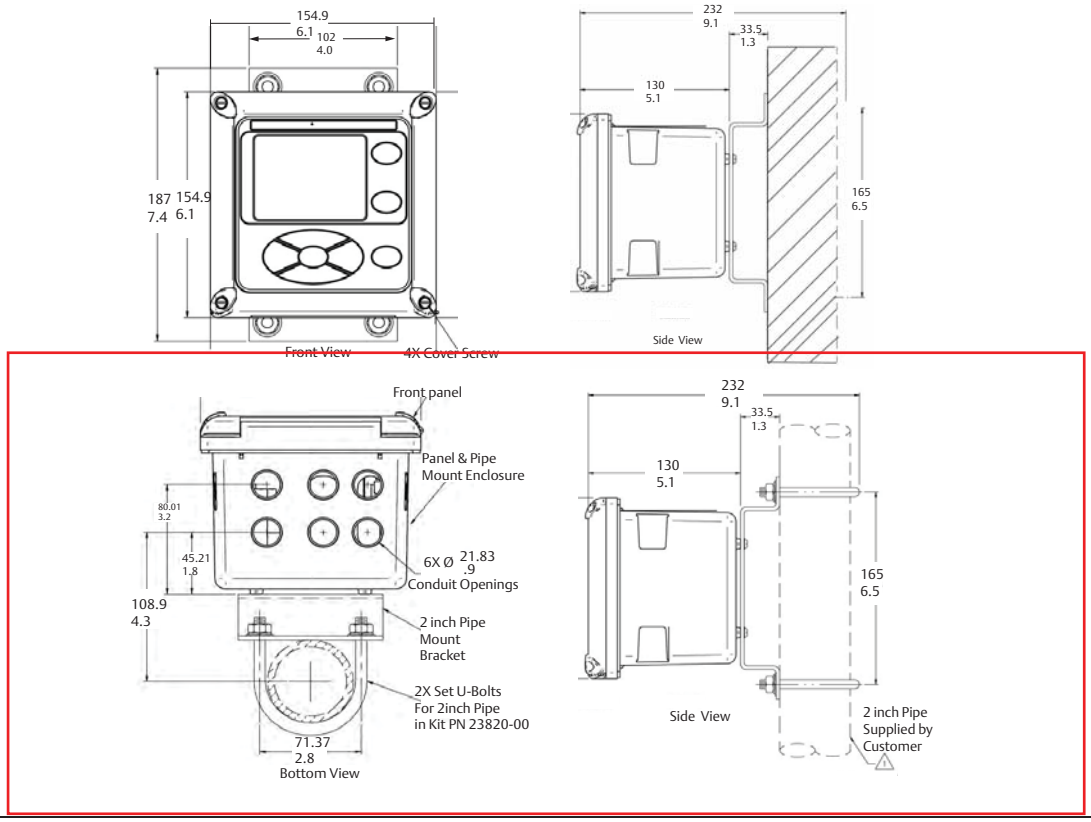


Figure 2. Wall Mount Dimensions



www.Emerson.com/RosemountLiquidAnalysis

YouTube.com/user/RosemountAnalytical

Analyticexpert.com

Twitter.com/Rosemount_News

Facebook.com/Rosemount

Emerson Automation Solutions
8200 Market Boulevard
Chanhassen, MN 55317,
USA
Tel +1 800 999 9307
Fax +1 952 949 7001
Liquid.CSC@Emerson.com

Features (1056 Transmitter)

Rosemount 1056 Analyser is a **MULTI- INSTRUMENT PARAMETER** - single or dual input. Choose from any combination of pH/ORP/ISL, Resistivity/Conductivity, % Concentration, Chlorine (Total, Free, Monochloramine, pH independent Free Chlorine), Oxygen, Ozone, Temperature, Turbidity, Flow, and 4-20mA Current Input

The Model 1056 dual input analyser offers single or dual sensor input with an unrestricted choice of dual measurements. This multi-parameter instrument offers a wide range of measurement choices supporting most industrial, commercial, and municipal applications.
The modular design allows signal input boards to be field replaced making configuration changes easy. Conveniently, live process values are always displayed during programming and calibration routines.

- **LARGE DISPLAY** – large easy to read process measurements
- **HART AND PROFIBUS DP** Digital Communications options
- **QUICK START PROGRAMMING**
- **DIGITAL COMMUNICATIONS**
- **DUAL SENSOR INPUT AND OUTPUT**
- The Model 1056 will automatically recognize Pt100, Pt1000 or 22k NTC RTDs built into the sensor.
- **SECURITY ACCESS CODES**
- **DIAGNOSTICS**- The analyzer continuously monitors its itself and the sensor(s) for problematic conditions. The display flashes Fault and/or Warning when these conditions occur.
- **Enclosure**: Polycarbonate. Type 4X, IP65.
- **Power Supply requirement Options** – 115VAC/230 VAC with no relays , 24 VDC with 4 alarm relays and Switching AC 85-265 VAC, 50/60 Hz with 4 alarm relays 20-30VDC and auto switching 85/265VAC power supplies shall be available. These power supplies shall each include four high load 5 amp. Alarm relays which can be configured independently and which include interval timer functionality. Fail-safe operation shall be supported to allow programmable default states for all relays
- **For PH sensors**- Automatic Buffer Recognition, Standardization, and Slope calibration methods

Features (499ACL Chlorine Sensor)

The Model 499ACL-01 sensor is intended for the continuous determination of free chlorine (hypochlorous acid plus hypochlorite ion) in water. The primary application is measuring chlorine in drinking water. The sensor requires no acid pretreatment and can measure free chlorine in samples having pH as high as 9.5 The 499ACL-01 is a membrane-covered amperometric sensor. The sensor consists of a hydrophilic membrane stretched tightly over a platinum cathode. A silver anode and an electrolyte solution complete the internal circuit. The 499ACL-01 sensor needs no pretreatment. Instead, the analyzer automatically applies a pH correction factor to the chlorine reading. If the sample pH varies more than 0.2 pH (peak-to-peak), an auxiliary pH sensor is required to provide the continuous pH correction

- **MEASURE FREE CHLORINE** without sample pre-treatment. No messy and expensive reagents needed.
- **AUTOMATIC CORRECTION** to at least pH 9.5.
- **EASILY REPLACEABLE MEMBRANE**; no special tools required.
- **AUTOMATIC COMPENSATION** for changes in membrane permeability with temperature.
- **AUTOMATIC PRESSURE EQUALIZATION** maintains correct membrane tension.
- **VARIOPOL CONNECTOR OPTION** allows the sensor to be replaced without running new cable.
- **Wetted Parts**: Noryl1, Viton2, silicone, platinum, and polyethersulfone.
- **Range**: 0 to 10 ppm (mg/L) as Cl2
- **Accuracy**: Accuracy depends on the accuracy of the chemical test used to calibrate the sensor.
- **Response time**: 22 sec to 95% of final reading at 25°C
- The sensor shall be a two-electrode membrane-covered sensor with a silver/silver chloride anode and a platinum cathode. The fill solution shall be potassium chloride.

PROJECT :	2 x 660MW ENNORE SEZ COAL BASED STPP		ELECTRO CHLORINATION SYSTEM		
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED		TECHNICAL DATASHEET OF TEMPERATURE ELEMENT		
BIDDER / VENDOR	DE NORA INDIA LIMITED		BHEL DOC. No. : PE-V11-412-174-A115		Rev
GENERAL	1	TAG NO(S)		90PBM23CT001	
	2	QUANTITY	No.	1	
	3	SERVICE		SEAWATER BOOSTER PUMP DISCHARGE TEMPERATURE	
	4	LOCATION		SAFE AREA	
PROCESS CONDITION	5	DUTY		CONTINUOUS	
	6	FLUID HANDLED		SEA WATER	
	7	FLUID TYPE		LIQUID	
	8	SPECIFIC GRAVITY		1.02	
	9	PROCES FLOW RATE	m3/h	133.3	
	10	PROCESS PRESSURE	Kg/Cm2	2.5	
	11	PROCESS TEMPERATURE	Deg C	25 ~ 32	
	12	DESIGN TEMPERATURE	Deg C	50	
	13	DESIGN PRESSURE	Kg/Cm2	5	
SHEATH AND FITTING	14	Housing type		Seamless tube	
	15	Fitting conn size		1/2 "	
	16	Mounting fitting type		screw type	
	17	Sheath outside dia	mm	6 mm	
	18	Spring loading		yes	
	19	Sheath material		316 SST	
	20	Fitting material		316 SST	
SENSING ELEMENT	21	Sensor type		RTD, PT 100	
	22	Sensor quantity		2 Nos	
	23	Temperature coefficient		0.00385 Ohm	
	24	Nominal resistance		100 Ohm @ 0 ºC	
	25	Configuration- wires		3 Wire	
	26	Sensor material		Platinum	
	27	Accuracy		Class 'A' - IEC 751 - permissible deviations with measuring temp as 0 Deg C - +/-0.06 Ohms.	
	28	Insulator material		Mineral insulator	
	29	Standard		IEC60751	
CONNECTION HEAD	30	Housing type		Weather proof enclosure	
	31	Element conn nom size		1/2 "NPT (M)	
	32	Signal conn nom size		1/2 " NPT (F)	
	33	Enclosure type number		IP 67	
	34	Grounding terminal location		External	
	35	Enclosure material		aluminium die cast	
	36	Terminal block material		Ceramic	
	37	Terminal material		nickel plated brass	
THERMOWELL	38	Construction type		Bar stock Tappered	
	39	End conn size/Rating		2 " Tappered/ 150#	
	40	End conn type / Style		Flanged / RF / F316+ cover plate in Monel 400	
	41	Internal conn nom size		1/2" NPT (F)	
	42	Bore diameter		7mm	
	43	TW insertion length U	mm	200	
	44	TW extension length T	mm	60	
	45	Head extension length N	mm	150	
	46	Thermowell material		Monel	
	47	Sheath material-thk		1 mm	
MISCELLANEOUS	48	MAKE		Pyro Electric Instruments Goa Private Limited	
	49	MODEL		400# Series-2-Pt 100(3w)-6-316-D-2-Monel 400-(F316+ cover plate in Monel 400)-U mm-T mm-2" 150# RF (B=19, B1=25, d=7, t=6)-Op 4, 17	

INSTRUMENT INDEX	Measurment/ Test	Input Min Range	Input Max range	Output Min Range	Output Max range
	Temperature Output signal	-200 Deg. C	850 Deg. C	18.5 Ohms	390.48 Ohms
		0 Deg. C	100 Deg. C	100 Ohms	138.51 Ohms

ACCESSORIES	1	SS Tag Plate with Tag no. and service Engraved

PROJECT :	2 x 660MW ENNORE SEZ COAL BASED STPP		ELECTRO CHLORINATION SYSTEM		
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED		TECHNICAL DATASHEET OF TEMPERATURE ELEMENT		
BIDDER / VENDOR	DE NORA INDIA LIMITED		BHEL DOC. No. : PE-V11-412-174-A115		Rev
GENERAL	1	TAG NO(S)		90PBM31CT001, '90PBM32CT001	
	2	QUANTITY	No.	2	
	3	SERVICE		TEMPERATURE AT OUTLET OF ELECTROLYSER	
	4	LOCATION		SAFE AREA	
OPERATING CONDITION	5	DUTY		CONTINUOUS	
	6	FLUID HANDLED		SODIUM HYPOCHLORITE	
	7	FLUID TYPE		LIQUID	
	8	SPECIFIC GRAVITY		1.022	
	9	PROCES FLOW RATE	m3/h	25	
	10	PROCESS PRESSURE	Kg/Cm2	2 ~ 2.5	
	11	PROCESS TEMPERATURE	Deg C	25 ~ 37	
	12	DESIGN TEMPERATURE	Deg C	50	
	13	DESIGN PRESSURE	Kg/Cm2	5	
SHEATH AND FITTING	14	Housing type		Seamless tube	
	15	Fitting conn size		1/2 "	
	16	Mounting fitting type		screw type	
	17	Sheath outside dia	mm	6 mm	
	18	Spring loading		yes	
	19	Sheath material		316 SST	
	20	Fitting material		316 SST	
SENSING ELEMENT	21	Sensor type		RTD, PT 100	
	22	Sensor quantity		2 Nos	
	23	Temperature coefficient		0.00385 Ohm	
	24	Nominal resistance		100 Ohm @ 0 ºC	
	25	Configuration- wires		3 Wire	
	26	Sensor material		Platinum	
	27	Accuracy		Class 'A' - IEC 751 - permissible deviations with measuring temp as 0 Deg C - +/-0.06 Ohms.	
	28	Insulator material		Mineral insulator	
	29	Standard		IEC60751	
CONNECTION HEAD	30	Housing type		Weather proof enclosure	
	31	Element conn nom size		1/2 "NPT (M)	
	32	Signal conn nom size		1/2 " NPT (F)	
	33	Enclosure type number		IP 67	
	34	Grounding terminal location		External	
	35	Enclosure material		aluminium die cast	
	36	Terminal block material		Ceramic	
	37	Terminal material		nickel plated brass	
THERMOWELL	38	Construction type		Bar stock Tappered	
	39	End conn size/Rating		2 " Tappered/ 150#	
	40	End conn type / Style		Flanged / RF / F316+ cover plate in Monel 400	
	41	Internal conn nom size		1/2" NPT (F)	
	42	Bore diameter		7mm	
	43	TW insertion length U	mm	200	
	44	TW extension length T	mm	60	
	45	Head extension length N	mm	150	
	46	Thermowell material		Monel	
	47	Sheath material-thk		1 mm	
MISCELLANEOUS	48	MAKE		Pyro Electric Instruments Goa Private Limited	
	49	MODEL		400# Series-2-Pt 100(3w)-6-316-D-2-Monel 400-(F316+ cover plate in Monel 400)-U mm-T mm-2" 150# RF (B=19, B1=25, d=7, t=6)-Op 4, 17	

INSTRUMENT INDEX	Measurment/ Test	Input Min Range	Input Max range	Output Min Range	Output Max range
	Temperature Output signal	-200 Deg. C	850 Deg. C	18.5 Ohms	390.48 Ohms
		0 Deg. C	100 Deg. C	100 Ohms	138.51 Ohms

ACCESSORIES	1	SS Tag Plate with Tag no. and service Engraved

PROJECT :	2 x 660MW ENNORE SEZ COAL BASED STPP			ELECTRO CHLORINATION SYSTEM		
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED			TECHNICAL DATASHEET OF TEMPERATURE TRANSMITTER		
BIDDER / VENDOR	DE NORA INDIA LIMITED			BHEL DOC. No. : PE-V11-412-174-A115		Rev
GENERAL	1	TAG NO(S)			90PBM23CT001	
	2	QUANTITY		No.	1	
	3	SERVICE			SEAWATER BOOSTER PUMP DISCHARGE TEMPERATURE	
	4	LOCATION			SAFE AREA	
PROCESS CONDITION	5	DUTY			CONTINUOUS	
	6	FLUID HANDLED			SEA WATER	
	7	FLUID TYPE			LIQUID	
	8	SPECIFIC GRAVITY			1.02	
	9	PROCES FLOW RATE		m3/h	133.3	
	10	PROCESS PRESSURE		Kg/Cm2	2.5	
	11	PROCESS TEMPERATURE		Deg C	25 ~ 32	
	12	DESIGN TEMPERATURE		Deg C	50	
	13	DESIGN PRESSURE		Kg/Cm2	5	
TRANSMITTER	14	Housing type			DUAL compartment	
	15	Input sensor type			Resistance thermometer	
	16	Input sensor quantity			2 Nos. (RTD Pt 100)	
	17	Output signal type		mA	4-20mA	
	18	Temperature span		Deg C	0-100 Deg C	
	19	Enclosure type number			IP 65	
	20	Characteristic curve			Linear to temperature	
	21	Digital communication			HART protocol	
	22	Signal power source			24 VDC 2 Wire	
	23	Configuration of wires			2 wire	
	24	Integral indicator style			LCD 5 digit	
	25	Signal termination type			integral juction box	
	26	Cert/Approval type			Non hazardous area	
	27	Mounting type			2" PIPE MOUNT	
	28	Enclosure material			Cast Aluminium Polyeurathene covered	
	29	Mounting bracket/Bolt material			SS304	
	30	Burnout protection			Upscale	
	31	Elec. conn. size/ type			1/2 " NPTF	
	32	Instrument Calibration Range		Deg C	0 ~ 80 º C	
	33	Accuracy			0.3% of Span	
MISCELLANEOUS	34	MAKE			EMERSON PROCESS MANAGEMENT	
	35	MODEL			644 D A NA D2 B4 M5 Q4	

INSTRUMENT INDEX	Measurment/ Test	Input Min Range	Input Max range	Output Min Range	Output Max range	
	Input Output signal	NA	NA	4 mA	20 mA	
	Temperature Scale	-200 Deg. C	850 Deg. C	0 Deg. C	80 Deg. C	

ACCESSORIES			
	1	mounting brackets in SS 304	
	2	SS Tag Plate with Tag no. and service Engraved	

PROJECT :	2 x 660MW ENNORE SEZ COAL BASED STPP			ELECTRO CHLORINATION SYSTEM				
PRINCIPAL CONTRACTOR :	BHARAT HEAVY ELECTRICALS LIMITED			TECHNICAL DATASHEET OF TEMPERATURE TRANSMITTER				
BIDDER / VENDOR	DE NORA INDIA LIMITED			BHEL DOC. No. : PE-V11-412-174-A115				Rev
GENERAL	1	TAG NO(S)			90PBM31CT001, '90PBM32CT001			
	2	QUANTITY		No.	2			
	3	SERVICE			TEMPERATURE AT OUTLET OF ELECTROLYSER			
	4	LOCATION			SAFE AREA			
OPERATING CONDITION	5	DUTY			CONTINUOUS			
	6	FLUID HANDLED			SODIUM HYPOCHLORITE			
	7	FLUID TYPE			LIQUID			
	8	SPECIFIC GRAVITY			1.022			
	9	PROCES FLOW RATE		m3/h	25			
	10	PROCESS PRESSURE		Kg/Cm2	2 ~ 2.5			
	11	PROCESS TEMPERATURE		Deg C	25 ~ 37			
	12	DESIGN TEMPERATURE		Deg C	50			
	13	DESIGN PRESSURE		Kg/Cm2	5			
TRANSMITTER	14	Housing type			DUAL compartment			
	15	Input sensor type			Resistance thermometer			
	16	Input sensor quantity			2 Nos. (RTD Pt 100)			
	17	Output signal type		mA	4-20mA			
	18	Temperature span		Deg C	0-100 Deg C			
	19	Enclosure type number			IP 65			
	20	Characteristic curve			Linear to temperature			
	21	Digital communication			HART protocol			
	22	Signal power source			24 VDC 2 Wire			
	23	Configuration of wires			2 wire			
	24	Integral indicator style			LCD 5 digit			
	25	Signal termination type			integral juction box			
	26	Cert/Approval type			Non hazardous area			
	27	Mounting type			2" PIPE MOUNT			
	28	Enclosure material			Cast Aluminium Polyeurathene covered			
	29	Mounting bracket/Bolt material			SS304			
	30	Burnout protection			Upscale			
	31	Elec. conn. size/ type			1/2 " NPTF			
	32	Instrument Calibration Range		Deg C	0 ~ 80 º C			
	33	Accuracy			0.3% of Span			
MISCELLANEOUS	34	MAKE			EMERSON PROCESS MANAGEMENT			
	35	MODEL			644 D A NA D2 B4 M5 Q4			
INSTRUMENT INDEX	Measurment/ Test		Input Min Range	Input Max range		Output Min Range	Output Max range	
	Input Output signal		NA	NA		4 mA	20 mA	
	Temperature Scale		-200 Deg. C	850 Deg. C		0 Deg. C	80 Deg. C	
ACCESSORIES	1	mounting brackets in SS 304						
	2	SS Tag Plate with Tag no. and service Engraved						

Temperature Element and Thermo well De-Coding		
400# Series-2-Pt 100(3w)-6-316-D-2-Monel 400-(F316+ cover plate in Monel 400)-U mm-T mm-2" 150# RF (B=19, B1=25, d=7, t=6)-Op 4, 17		
Model	400# Series	
Number of Elements	2	Duplex
Element Type	Pt 100	Pt 100 RTD
Sheath Dia	6	6 mm
Sheath Material	316	SS 316
Head Type	D	Wheather proof
Electrical connection	2	Two Entries
ThermoWell Material	Monel 400	Monel 400
Flange Material	F316+ cover plate in Monel 400	F316+ cover plate in Monel 400
TW insertion length	U - mm	200
TW extension length	T - mm	60
Head extension length	N- mm	150
Process connection	2" 150# RF	2 " ANSI rating 150 #, RF
Thermowell Dimension	B =19	Dimension in mm refer thermowell GAD
	B1 =25	
	D =7	
	T=6	

Rosemount 644 Temperature Transmitter

The most versatile temperature transmitter

Reduce complexity and simplify the day to day operations of your diverse temperature applications with the versatile Rosemount 644 family of temperature transmitters. Make better decisions for your process with the new and easy to use Rosemount 644 Transmitter capabilities including: diagnostics, safety certification, integral transient protection and display options.

Rosemount 644 Family of Transmitters

Fit your needs within one model family with a customizable transmitter design

- DIN Head mount, field mount, and rail mount form factors
- 4-20 mA /HART® with Selectable Revisions, FOUNDATION™ fieldbus or PROFIBUS® PA Protocol support
- SIL3 Capable: IEC 61508 certified by an accredited 3rd party agency for use in safety instrumented systems up to SIL 3 [Minimum requirement of single use (1oo1) for SIL 2 and redundant use (1oo2) for SIL 3]
- Enhanced display with Local Operator Interface
- LCD display
- Integral Transient Protection
- Enhanced accuracy and stability
- Transmitter-Sensor Matching with Callendar Van Dusen constants
- Variety of enclosures

Rosemount 644 Selection Guide

Rosemount 644 HART Transmitters

HART head mount and field mount

- Single or Dual sensor inputs for RTD, Thermocouple, mV and Ohm
- DIN A Head mount and Field mount transmitters
- SIL3 Capable: IEC 61508 certified by an accredited 3rd party agency for use in safety instrumented systems up to SIL 3 (Minimum requirement of single use [1oo1] for SIL 2 and redundant use [1oo2] for SIL 3)
- LCD display
- Enhanced display with Local Operator Interface
- Integral Transient Protection
- Diagnostic Suite
- Enhanced accuracy and stability
- Transmitter-Sensor Matching with Callendar Van Dusen constants

HART rail mount

- Single sensor input for RTD, Thermocouple, mV and Ohm
- Custom alarm and saturation levels
- Transmitter-Sensor Matching with Callendar Van Dusen constants
- Hardware alarm switch

Contents

Rosemount 644 FOUNDATION fieldbus

- Single sensor input for RTD, Thermocouple, mV and Ohm
- DIN A Head mount transmitter
- Standard function blocks: 2 Analog Inputs, 1 PID and 1 Backup Link Active Scheduler (LAS)
- LCD Display
- ITK 5.01 Compliant
- Transmitter Sensor Matching with Callendar Van Dusen constants

Rosemount 644 PROFIBUS PA

- Single sensor input for RTD, Thermocouple, mV and Ohm
- DIN A Head mount transmitter
- Standard function blocks: 1 physical, 1 Transducer, and 1 Analog Out
- LCD Display
- Compliant to PROFIBUS PA Profile 3.02
- Transmitter-Sensor Matching with Callendar Van Dusen constants

Easy to use human-centered designs to make your job simple

- Diagnostic information and process health at your finger tips with intuitive Device Dashboards.
- Communication clips are easily accessible when an LCD display is attached.
- Easy wiring practices with captive sensor screw terminals, an optimized wiring diagram, and field mount enclosure option.

Optimize plant efficiency and increase visibility into the process with an expansive diagnostic offering

- Keep your process up and running with the Hot Backup™ feature where if your primary sensor fails, a second sensor seamlessly takes over and prevents the measurement failure.
- Tighten control with Sensor Drift Alert that detects drifting sensors and pro-actively notifies the user.
- Enable predictive maintenance practices with Thermocouple Degradation Diagnostic that monitors the health of the thermocouple loop.
- Improve quality with Minimum and Maximum Temperature Tracking that records temperature extremes of the process and the ambient environment.

Ordering Information

The Rosemount 644 is a Versatile Temperature Transmitter that delivers field reliability and advanced accuracy and stability to meet demanding process needs.

Transmitter features include:

- HART/4-20 mA with Selectable Revision 5 and 7 selectable (Option Code A), FOUNDATION fieldbus (Option Code F) or PROFIBUS PA (Option Code W)
- DIN A Head Mount, Field Mount, or Rail Mount transmitter styles
- Dual Sensor Input (Option Code S)
- SIS SIL 2 Safety Certification (Option Code QT)
- LCD Display (Option Code M5)
- Local Operator Interface (Option Code M4)
- Advanced Diagnostics (Option Codes DC and DA1)
- Enhanced Transmitter Accuracy and Stability (Option Code P8)
- Transmitter-Sensor Matching (Option Code C2)

Specification and selection of product materials, options, or components must be made by the purchaser of the equipment. See page 14 for more information on Material Selection.

Table 1. Rosemount 644 Smart Temperature Transmitter Ordering Information

★ The Standard offering represents the most common models and options. These options should be selected for best delivery.
The Expanded offering is manufactured after receipt of order and is subject to additional delivery lead time.

● = Available
– = Not Available

Model	Product description					
644	Temperature Transmitter					
Transmitter type						
H	DIN A Head Mount - Single Sensor Input					★
R	Rail Mount - Single Sensor Input					★
S	DIN A Head Mount - Dual Sensor Input (HART only)					★
F[1]	Field Mount - Single Sensor Input (HART only)					★
D[1]	Field Mount - Dual Sensor Input (HART only)					★
Output		**Head**			**Rail**	
A	4–20 mA with digital signal based on HART protocol	●			●	★
F	FOUNDATION fieldbus digital signal (includes 2 AI function blocks and Backup Link Active Scheduler)	●			–	★
W	PROFIBUS PA digital signal	●			–	★
Product certifications		**Head**			**Rail**	
Hazardous locations certificates (consult factory for availability[2])		A	F	W	A	
NA	No approval	●	●	●	●	★
E5	FM Explosion-proof; Dust Ignition-proof	●	●	●	–	★

Table 1. Rosemount 644 Smart Temperature Transmitter Ordering Information

★ The Standard offering represents the most common models and options. These options should be selected for best delivery.
The Expanded offering is manufactured after receipt of order and is subject to additional delivery lead time.

● = Available
– = Not Available

		Head			Rail	
		A	F	W	A	
I5	FM Intrinsically Safe; Non-incendive	●	●	●	●	★
K5	FM Explosionproof; Intrinsically Safe; Non-incendive; Dust Ignition-proof	●	●	●	–	★
NK	IECEx Dust	●	–	–	–	★
KC	FM and CSA Intrinsically Safe and Non-incendive	–	–	–	●	★
KB	FM and CSA: Explosionproof; Intrinsically Safe; Non-incendive; Dust Ignition-proof	●	–	–	–	★
KD	FM, CSA and ATEX Explosionproof, Intrinsically Safe	●	●	●		★
I6	CSA Intrinsically Safe	●	●	●	●	★
K6	CSA Explosionproof; Intrinsically Safe; Non-incendive; Dust Ignition-proof	●	●	●	–	★
I3	China Intrinsic Safety	●	–	–	–	★
E3	China Flameproof	●	●	●	–	★
N3	Chine Type n	●	–	–	–	★
E1	ATEX Flameproof	●	●	●	–	★
N1	ATEX Type n	●	●	●	–	★
NC	ATEX Type n Component	●	●	●	●	★
K1	ATEX Flameproof; Intrinsic Safety; Type n; Dust	●	●	●		★
ND	ATEX Dust Ignition–Proof	●	●	●	–	★
KA	CSA and ATEX: Explosionproof; Intrinsically Safe; Non-incendive	●	–	–	–	★
I1	ATEX Intrinsic Safety	●	●	●	●	★
E7	IECEx Flameproof	●	●	●	–	★
I7	IECEx Intrinsic Safety	●	●	●	●	★
N7	IECEx Type n	●	●	●	–	★
NG	IECEx Type n Component	●	●	●	●	★
K7	IECEx Flameproof; Intrinsic Safety; Type n; Dust	●	–	–	–	★
I2	INMETRO Intrinsic Safety	●	–	–	–	★
E4	TIIS Flameproof	●	●	–	–	★
E2	INMETRO Flameproof	●	●	●	–	★
EM	Technical Regulations Customs Union (EAC) Flameproof	●	●	●	–	★
IM	Technical Regulations Customs Union (EAC) Intrinsic Safety	●	●	●	–	★
KM	Technical Regulations Customs Union (EAC) Flameproof, Intrinsic Safety	●	●	●	–	★

Options

		Head			Rail	
		A	F	W	A	
PlantWeb standard diagnostic functionality						
DC	Diagnostics: Hot Backup and Sensor Drift Alert	●	–	–	–	★

Table 1. Rosemount 644 Smart Temperature Transmitter Ordering Information

★ **The Standard offering represents the most common models and options. These options should be selected for best delivery.**
The Expanded offering is manufactured after receipt of order and is subject to additional delivery lead time.

● = Available
– = Not Available

PlantWeb advanced diagnostic functionality									
DA1	HART Sensor and Process Diagnostic Suite: Thermocouple Diagnostic and Min/Max Tracking				●	–	–	–	★
Enclosure options					**Head**			**Rail**	
					A	F	W	A	
	Housing style	**Material**	**Entry size**	**Diameter**					
J5(3)(4)	Universal Junction Box, 2 entries	Aluminum	M20 X 1.5	3 in (76 mm)	●	●	●	–	★
J6(4)	Universal Junction Box, 2 entries	Aluminum	1/2–14 NPT	3 in (76 mm)	●	●	●	–	★
R1	Rosemount Connection Head, 2 entries	Aluminum	M20 X 1.5	3 in (76 mm)	●	●	●	–	★
R2	Rosemount Connection Head, 2 entries	Aluminum	1/2–14 NPT	3 in (76 mm)	●	●	●	–	★
J1(3)	Universal Junction Box, 3 entries	Aluminum	M20 X 1.5	3.5 in (89 mm)	●	●	●	–	★
J2	Universal Junction Box, 3 entries	Aluminum	1/2–14 NPT	3.5 in (89 mm)	●	●	●	–	★
D1(1)(3)(5)	Field Mount Housing, Separate Terminal Compartment	Aluminum	M20 X 1.5	3.5 in (89 mm)	–	–	–	–	★
D2(1)(5)	Field Mount Housing, Separate Terminal Compartment	Aluminum	1/2–14 NPT	3.5 in (89 mm)	–	–	–	–	★
J3(3)	Universal Junction Box, 3 entries	Cast SST	M20 X 1.5	3.5 in (89 mm)	●	●	●	–	
J4	Universal Junction Box, 3 entries	Cast SST	1/2–14 NPT	3.5 in (89 mm)	●	●	●	–	
J7(3)(4)	Universal Junction Box, 2 entries	Cast SST	M20 X 1.5	3 in (76 mm)	●	●	●	–	
J8(4)	Universal Junction Box, 2 entries	Cast SST	1/2–14 NPT	3 in (76 mm)	●	●	●	–	
R3	Rosemount Connection Head, 2 entries	Cast SST	M20 X 1.5	3 in (76 mm)	●	●	●	–	
R4	Rosemount Connection Head, 2 entries	Cast SST	1/2–14 NPT	3 in (76 mm)	●	●	●	–	
S1	Connection Head, 2 entries	Polished SST	1/2–14 NPT	3 in (76 mm)	●	●	●	–	
S2	Connection Head, 2 entries	Polished SST	1/2–14 NPSM	3 in (76 mm)	●	●	●	–	
S3	Connection Head, 2 entries	Polished SST	M20 X 1.5	3 in (76 mm)	●	●	●	–	
S4	Connection Head, 2 entries	Polished SST	M20 X 1.5, M24 X 1.4	3 in (76 mm)	●	●	●	–	
Mounting bracket									
B4(6)	316 SST U-bolt Mounting Bracket, 2-in pipe mount				●	●	●	–	★
B5(6)	"L" Mounting Bracket for 2-inch pipe or panel mounting				●	●	●	–	★
Display and interface options									
M4	LCD Display with Local Operator Interface				●	–	–	–	★
M5	LCD Display				●	●	●	–	★
Software configuration									
C1	Custom Configuration of Date, Descriptor and Message (requires CDS with order)				●	●	●	●	★
Enhanced performance									
P8(7)	Enhanced Transmitter Accuracy and Stability				●	–	–	–	★

Table 1. Rosemount 644 Smart Temperature Transmitter Ordering Information

★ The Standard offering represents the most common models and options. These options should be selected for best delivery.
The Expanded offering is manufactured after receipt of order and is subject to additional delivery lead time.

● = Available
– = Not Available

Alarm level configuration						
A1	NAMUR alarm and saturation levels, high alarm	●	–	–	●	★
CN	NAMUR alarm and saturation levels, low alarm	●	–	–	●	★
C8	Low Alarm (Standard Rosemount Alarm and Saturation Values)	●	–	–	●	★
Line filter		**Head**			**Rail**	
F5	50 Hz Line Voltage Filter	●	●	●	●	★
F6	60 Hz Line Voltage Filter	●	●	●	●	★
Sensor trim						
		A	F	W	A	
C2	Transmitter-Sensor Matching - Trim to Specific Rosemount RTD Calibration Schedule (CVD constants)	●	●	●	●	★
5-point calibration option						
C4	5-point calibration (use option code Q4 to generate a calibration certificate)	●	●	●	●	★
Calibration certificate						
Q4	Calibration certificate (3-Point calibration with certificate)	●	●	●	●	★
QP	Calibration Certification & Tamper Evident Seal	●	●	●	–	★
Quality certification for safety						
QT	Safety Certified to IEC 61508 with certificate of FMEDA data	●	–	–	–	★
Shipboard certification						
SBS	American Bureau of Shipping (ABS) Type Approval	●	●	●	–	★
SBV	Bureau Veritas (BV) Type Approval	●	●	●	–	★
SDN	Det Norske Veritas (DNV) Type Approval	●	●	●	–	★
SLL	Lloyd's Register (LR) Type Approval	●	●	●	–	★
External ground						
G1	External ground lug assembly (see “External ground screw assembly” on page 11)	●	●	●	–	★
Transient protection						
T1[8]	Integral Transient Protector	●	–	–	–	★
Cable gland option						
G2	Cable gland (7.5 mm - 11.99 mm)	●	●	●	–	★
G7	Cable gland, M20x1.5, Ex e, Blue Polyamide (5 mm - 9 mm)	●	●	●	–	★
Cover chain option						
G3	Cover chain	●	●	●	–	★
Conduit electrical connector						
GE[9]	M12, 4-pin, Male Connector (eurofast®)	●	●	●	–	★
GM[9]	A size Mini, 4-pin, Male Connector (minifast®)	●	●	●	–	★

Table 1. Rosemount 644 Smart Temperature Transmitter Ordering Information

★ **The Standard offering represents the most common models and options. These options should be selected for best delivery.**
The Expanded offering is manufactured after receipt of order and is subject to additional delivery lead time.

● = Available
– = Not Available

External label						
EL	External label for ATEX Intrinsic Safety	●	●	●	–	★
HART revision configuration		**Head**			**Rail**	
		A	F	W	A	
HR5	Configured for HART Revision 5	●	–	–	–	★
HR7(10)	Configured for HART Revision 7	●	–	–	–	★
Assemble to options						
XA	Sensor Specified Separately and Assembled to Transmitter	●	●	●	–	★
Extended product warranty						
WR3	3-year limited warranty	●	●	●	●	★
WR5	5-year limited warranty	●	●	●	●	★

Typical rail mount model number: 644 R A I5
Typical head mount model number: 644 S A I5 DC DA1 J5 M5
Typical field mount model number: 644 F A I5 DC DA1 D1 M4 T1

(1) Consult factory on availability.
(2) See Table 2 for the validity of enclosures with individual approval options.
(3) When ordered with XA, 1/2-in. NPT enclosure will come equipped with an M20 adapter with the sensor installed as a process ready.
(4) Enclosure ships equipped with 50.8 mm (2-in) SST pipe "U" bolt mounting kit.
(5) Available with Transmitter Type 644F or 644D only.
(6) Bracket assembly only available with J1, J2, J3, J4, D1, and D2.
(7) See Table 10 for Enhanced Accuracy specifications.
(8) Transient Protection option requires the use of J1, J2, J3, J4, D1, or D2.
(9) Available with Intrinsically Safe approvals only. For FM Intrinsically Safe or non-incendive approval (option code I5), install in accordance with Rosemount drawing 03151-1009.
(10) Configures the HART output to HART Revision 7. The device can be field configured to HART Revision 5 if needed.

Note
For additional options (e.g. "K" codes), contact your local Emerson Process Management representative.

Table 2. 644 Enclosure Options Valid with Individual Approval Codes

Code	Hazardous location approval description	Enclosure options valid with approval
NA	No approval	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8, S1, S2, S3, S4, D1, D2
E5	FM Explosionproof; Dust Ignition-proof	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8, D1, D2
I5	FM Intrinsically Safe; Non-incendive	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8, D1, D2
K5	FM Explosionproof; Intrinsically Safe; Non-incendive; Dust Ignition-proof	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8, D1, D2
NK	IECEx Dust	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8, D1, D2
KC	FM and CSA Intrinsically Safe and Non-incendive	Only available with Rail mount device
KB	FM and CSA: Explosionproof; Intrinsically Safe; Non-incendive; Dust Ignition-proof	J2, J4, R2, R4, J6, J8, D2
KD	FM, CSA and ATEX Explosionproof, Intrinsically Safe	J2, J4, R2, R4, J6, J8, D2
I6	CSA Intrinsically Safe	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8, D1, D2
K6	CSA Explosionproof; Intrinsically Safe; Non-incendive; Dust Ignition-proof	J2, J4, R2, R4, J6, J8, D2
I3	China Intrinsic Safety	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8
E3	China Flameproof	R1, R2, R3, R4, J5, J6, J7, J8
N3	China Type n	R1, R2, R3, R4, J5, J6, J7, J8
E1	ATEX Flameproof	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8, D1, D2
N1	ATEX Type n	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8, D1, D2
NC	ATEX Type n Component	None
K1	ATEX Flameproof; Intrinsic Safety; Type n; Dust	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8, D1, D2
ND	ATEX Dust Ignition-Proof	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8, D1, D2
KA	CSA and ATEX: Explosionproof; Intrinsically Safe; Non-incendive	J2, J4, R2, R4, J6, J8, D2
I1	ATEX Intrinsic Safety	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8, S1, S2, S3, S4, D1, D2
E7	IECEx Flameproof	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8, D1, D2
I7	IECEx Intrinsic Safety	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8, S1, S2, S3, S4, D1, D2
N7	IECEx Type n	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8, D1, D2
NG	IECEx Type n Component	None
K7	IECEx Flameproof; Intrinsic Safety; Type n; Dust	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8, D1, D2
I2	INMETRO Intrinsic Safety	J1, J2, J3, J4, R1, R2, R3, R4, J5, J6, J7, J8
E4	TIIS Flameproof	J2, J6
E2	INMETRO Flameproof	R1, R2, R3, R4, J5, J6, J7, J8
KM	Technical Regulations Customs Union (EAC) Flameproof, Intrinsic Safety	J1, J2, J3, J4,J5,J6, J7, J8, R1, R2, R3, R4, S1, S2, S3, S4
IM	Technical Regulations Customs Union (EAC) Intrinsic Safety	J1, J2, J3, J4,J5,J6, J7, J8, R1, R2, R3, R4, S1, S2, S3, S4
EM	Technical Regulations Customs Union (EAC) Flameproof	J1, J2, J3, J4,J5,J6, J7, J8, R1, R2, R3, R4, S1, S2, S3, S4
K2	INMETRO Flameproof, Intrinsic Safety	R1, R2, R3, R4, J5, J6, J7, J8

Tagging

Hardware

- 13 characters total
- Tags are adhesive or metal labels
- Tag is permanently attached to transmitter

Software

- The transmitter can store up to 13 characters for FOUNDATION fieldbus and PROFIBUS PA or 8 for HART protocol. If no characters are specified, the first 8 characters of the hardware tag are the default. An optional 32 character Long Software Tag is available when option code HR7 is ordered.

Considerations

External ground screw assembly

The external ground screw assembly can be ordered by specifying code G1 when an enclosure is specified. However, some approvals include the ground screw assembly in the transmitter shipment, hence it is not necessary to order code G1. The table below identifies which approval options include the external ground screw assembly and which do not.

Option code	External ground screw assembly included?
E5, I1, I2, I5, I6, I7, K5, K6, NA, I3, KB	No–Order option code G1
E1, E2, E3, E4, E7, K7, N1, N7, ND, K1, K2, KA, NK, N3, KD, T1	Yes

Table 3. Enclosure Spares

Description	Part number
Universal Head, Aluminum, Standard cover, 2-conduit - M20 entries	00644-4420-0002
Universal Head, Aluminum, Display cover, 2-conduit - M20 entries	00644-4420-0102
Universal Head, Aluminum, Standard cover, 2-conduit - 1/2 - 14 NPT entries	00644-4420-0001
Universal Head, Aluminum, Display cover, 2-conduit - 1/2 - 14 NPT entries	00644-4420-0101
Universal Head, SST, Standard cover, 2-conduit - M20 entries	00644-4433-0002
Universal Head, SST, Display cover, 2-conduit - M20 entries	00644-4433-0102
Universal Head, SST, Standard cover, 2-conduit - 1/2 - 14 NPT entries	00644-4433-0001
Universal Head, SST, Display cover, 2-conduit - 1/2 - 14 NPT entries	00644-4433-0101
Connection Head, Aluminum, Standard cover, 2-conduit - M20 x 1/2 ANPT entries	00644-4410-0021
Connection Head, Aluminum, Display cover, 2-conduit - M20 x 1/2 ANPT entries	00644-4410-0121
Connection Head, Aluminum, Standard cover, 2-conduit - 1/2 - 14 NPT x 1/2 ANPT entries	00644-4410-0011
Connection Head, Aluminum, Display cover, 2-conduit - 1/2 - 14 NPT x 1/2 ANPT entries	00644-4410-0111
Connection Head, SST, Standard cover, 2-conduit - M20 X 1/2 ANPT entries	00644-4411-0021
Connection Head, SST, Display cover, 2-conduit - M20 X 1/2 ANPT entries	00644-4411-0121
Connection Head, SST, Standard cover, 2-conduit - 1/2 - 14 NPT x 1/2 ANPT entries	00644-4411-0011
Connection Head, SST, Display cover, 2-conduit - 1/2 - 14 NPT x 1/2 ANPT entries	00644-4411-0111
Connection Head, Polished SST, Standard cover, 2-conduit - M20 x 1.5 entries	00079-0312-0033
Connection Head, Polished SST, Display cover, 2-conduit - M20 x 1.5 entries	00079-0312-0133
Connection Head, Polished SST, Standard cover, 2-conduit - M20 x 1.5 / M24 x 1.5 entries	00079-0312-0034
Connection Head, Polished SST, Display cover, 2-conduit - M20 x 1.5 / M24 x 1.5 entries	00079-0312-0134
Connection Head, Polished SST, Standard cover, 2-conduit - 1/2 -14 NPT entries	00079-0312-0011
Connection Head, Polished SST, Display cover, 2-conduit - 1/2 -14 NPT entries	00079-0312-0111
Connection Head, Polished SST, Standard cover, 2-conduit - 1/2 -14 NPSM entries	00079-0312-0022
Connection Head, Polished SST, Display cover, 2-conduit - 1/2 -14 NPSM entries	00079-0312-0122

Table 3. Enclosure Spares

Description	Part number
Universal Head, Aluminum, Standard cover, 3-conduit - M20 entries	00644-4439-0001
Universal Head, Aluminum, Display cover, 3-conduit - M20 entries	00644-4439-0101
Universal Head, Aluminum, Standard cover, 3-conduit - 1/2 - 14 NPT entries	00644-4439-0002
Universal Head, Aluminum, Display cover, 3-conduit - 1/2 - 14 NPT entries	00644-4439-0102
Universal Head, SST, Standard cover, 3-conduit - M20 entries	00644-4439-0003
Universal Head, SST, Display cover, 3-conduit - M20 entries	00644-4439-0103
Universal Head, SST, Standard cover, 3-conduit - 1/2 - 14 NPT entries	00644-4439-0004
Universal Head, SST, Display cover, 3-conduit - 1/2 - 14 NPT entries	00644-4439-0104

Table 4. Display Kit Spares

Description	Part number
Display only	
644 HART LCD Display (option M5)	00644-7630-0001
644 HART Local Operator Interface (option M4)	00644-7630-1001
644 FOUNDATION fieldbus LCD Display (option M5)	00644-4430-0002
644 PROFIBUS PA LCD Display (option M5)	00644-4430-0002
644 HART Legacy display Kit (option M5 - Device Rev 7)	00644-4430-0002
Display with aluminum meter cover	
Rosemount 644 HART LCD Display (option M5)(1)	00644-7630-0011
Rosemount 644 HART LCD Display (option M5)(2)	00644-7630-0111
Display with aluminum cover	
Rosemount 644 HART Local Operator Interface (option M4)(1)	00644-7630-1011
Rosemount 644 HART Local Operator Interface (option M4)(2)	00644-7630-1111
Rosemount 644 FOUNDATION fieldbus LCD Display (option M5)(1)	00644-4430-0001
Rosemount 644 PROFIBUS PA LCD Display (option M5)(1)	00644-4430-0001
Rosemount 644 HART Legacy display Kit (option M5)(1)	00644-4430-0001
Display with SST meter cover	
Rosemount 644 HART LCD Display (option M5)(1)	00644-7630-0021
Rosemount 644 HART LCD Display (option M5)(2)	00644-7630-0121
Rosemount 644 HART Local Operator Interface (option M4)(1)	00644-7630-1021
Rosemount 644 HART Local Operator Interface (option M4)(2)	00644-7630-1121
Rosemount 644 FOUNDATION fieldbus LCD Display (option M5)(1)	00644-4430-0011
Rosemount 644 PROFIBUS PA LCD Display (option M5)(1)	00644-4430-0011
Rosemount 644 HART Legacy display Kit (option M5)(1)	00644-4430-0011

(1) Covers provided are compatible with the 3-in (76 mm) Universal Junction Box and Rosemount Connection Head enclosure styles.
(2) Cover provided is compatible with the 3.5-in (89 mm) Universal Junction Box and Field Mount enclosure styles.

Table 5. Transient Protection Spares

Description	Part number
Transient Protector without Enclosure	00644-4437-0001
Transient Protector with Universal Head, Aluminum, Standard cover, 3-conduit - M20	00644-4438-0001
Transient Protector with Universal Head, Aluminum, Display cover, 3-conduit - M20	00644-4438-0101
Transient Protector with Universal Head, Aluminum, Standard cover, 3-conduit - 1/2 NPT	00644-4438-0002
Transient Protector with Universal Head, Aluminum, Display cover, 3-conduit - 1/2 NPT	00644-4438-0102
Transient Protector with Universal Head, SST, Standard cover, 3-conduit - M20	00644-4438-0003
Transient Protector with Universal Head, SST, Display cover, 3-conduit - M20	00644-4438-0103
Transient Protector with Universal Head, SST, Standard cover, 3-conduit - 1/2 NPT	00644-4438-0004
Transient Protector with Universal Head, SST, Display cover, 3-conduit - 1/2 NPT	00644-4438-0104

Table 6. Miscellaneous Accessories

Description	Part number
Ground Screw Assembly Kit(1)	00644-4431-0001
Ground Screw Assembly Kit(2)	00644-4431-0002
Mounting Screws and Springs	00644-4424-0001
Hardware Kit for mounting a Rosemount 644 Head mount to a DIN rail (includes clips for symmetrical and asymmetrical rails)	00644-5301-0010
U-Bolt mounting Kit for Universal Housing	00644-4423-0001
Universal Clip for Rail or Wall Mount	03044-4103-0001
24 Inches of Symmetric (Top Hat) Rail	03044-4200-0001
24 Inches of Asymmetric (G) Rail	03044-4201-0001
Ground Clamp for symmetric or asymmetric rail	03044-4202-0001
Snap Rings Kit (used for assembly to a DIN sensor)	00644-4432-0001
Cover Clamp Assembly	00644-4434-0001
Terminal Block, 13mm M4 Mounting Screws	00065-0305-0001
U-bolt Mounting Bracket, 2-in pipe mount (option B4)	00644-7610-0001
L - Mounting Bracket for 2-inch pipe or panel mounting (option B5)	00644-7611-0001

(1) Compatible with the 3-in (76 mm) Universal Junction Box and Rosemount Connection Head enclosure styles.
(2) Compatible with the 3.5-in (89 mm) Universal Junction Box and Field Mount enclosure styles.

Specifications

HART, FOUNDATION fieldbus, and PROFIBUS PA

Functional specifications

Inputs

User-selectable; sensor terminals rated to 42.4 Vdc. See "Accuracy" on page 20 for sensor options.

Output

Single 2-wire device with either 4–20 mA/HART, linear with temperature or input; or completely digital outputs with FOUNDATION fieldbus communication (ITK 5.01 compliant), or PROFIBUS PA (compliant with profile 3.02).

Isolation

Input/output isolation tested to 600 Vrms.

Local display options

LCD display

An optional 11 digit, 2 line integral LCD display operates with a floating or fixed decimal point. It displays engineering units (°F, °C, °R, K, Ohms and mV), mA, and percent of range. The display can be configured to alternate between selected display options. Display settings are pre-configured at the factory according to the standard transmitter configuration. They can be re-configured in the field using either HART, FOUNDATION fieldbus, or PROFIBUS PA communications.

LCD display with local operator interface

An optional 14-digit, 2-line integral LCD display operates with a floating or fixed decimal point. The LOI includes all features and functionality available in the regular display with an added 2-button configuration capability directly at the display interface. The LOI also has optional password protection for secure operations. The LOI is only available on the 644 HART Head mount and Field mount transmitters.

For more information on the LOI configuration options or further functionality that the LOI offers, see Appendix D: Local Operator Interface (LOI) in the Rosemount 644 Temperature Transmitter Product Manual (00809-0200-4728), available on rosemount.com.

Humidity limits

0–95% relative humidity

Update time

≤ 0.5 sec. per sensor

Accuracy (default configuration) PT 100

HART Standard: ±0.15 °C
HART Enhanced: ±0.1 °C
FOUNDATION fieldbus: ±0.15 °C
PROFIBUS PA: ±0.15 °C

Physical specifications

Material selection

Emerson provides a variety of Rosemount product with various product options and configurations including materials of construction that can be expected to perform well in a wide range of applications. The Rosemount product information presented is intended as a guide for the purchaser to make an appropriate selection for the application. It is the purchaser's sole responsibility to make a careful analysis of all process parameters (such as all chemical components, temperature, pressure, flow rate, abrasives, contaminants, etc.), when specifying product, materials, options and components for the particular application. Emerson Process Management is not in a position to evaluate or guarantee the compatibility of the process fluid or other process parameters with the product, options, configuration or materials of construction selected.

Conformance to specifications (±3σ [Sigma])

Technology leadership, advanced manufacturing techniques, and statistical process control ensure specification conformance to at least ±3σ.

Electrical connections

Model	Power and sensor terminals
644 Head (HART)	Captivated screw terminals permanently fixed to terminal block
644 Head (FOUNDATION fieldbus/PROFIBUS)	Compression screw terminals permanently fixed to the terminal block
644 Field Mount (HART)	Captivate screw terminals permanently fixed to the terminal block
644 Rail (HART)	Compression screw permanently fixed to front panel

Field Communicator connections

Communication terminals	
644 Head/Field	Clips permanently fixed to terminal block
644 Rail	Clips permanently fixed to front panel

Materials of construction

Electronics housing and terminal block	
644 Head mount/Field mount	GE polyphenylene oxide glass reinforced
644 Rail mount	Polycarbonate
Enclosure (options J1, J2, J5, J6, R1, R2, D1, and D2)	
Housing	Low-copper aluminum
Paint	Polyurethane
Cover O-ring	Buna-N

Materials of construction (stainless steel housing for biotechnology, pharmaceutical industries, and sanitary applications)

Housing and standard meter cover

- 316 SST

Cover O-ring

- Buna-N

Mounting

The 644R attaches directly to a wall or a DIN rail. The 644H installs in a connection head or universal head mounted directly on a sensor assembly, apart from a sensor assembly using a universal head, or to a DIN rail using an optional mounting clip.

Special mounting considerations

See "Mounting kits for 644H" on page 26 for the special hardware that is available to:

- Mount a 644H to a DIN rail. (see Table 3 on page 11)
- Retrofit a new 644H to replace an existing 644H Transmitter in an existing threaded sensor connection head. (see Table 3 on page 11)

Weight

Code	Options	Weight
644H	HART, Head Mount Transmitter	95 g (3.39 oz)
644H	FOUNDATION fieldbus, Head Mount Transmitter	92 g (3.25 oz)
644H	PROFIBUS PA Head Mount Transmitter	92 g (3.25 oz)
644R	HART, Rail Mount Transmitter	174 g (6.14 oz)
M5	LCD Display	35 g (1.34 oz)
M4	LCD Display with Local Operator Interface	35g (1.34 oz)
J1, J2	Universal Head, 3-conduits, Standard Cover	200 g (7.05 oz)
J1, J2	Universal head, 3-conduits, Meter Cover	307 g (10.83 oz)
J3, J4	Cast SST Universal head, 3-conduits, Standard Cover	2016 g (71.11 oz)
J3, J4	Cast SST Universal head, 3-conduits, Meter Cover	2122 g (74.85 oz)
J5, J6	Aluminum 2-conduits, Universal Head, Standard Cover	577 g (20.35 oz)
J5, J6	Aluminum 2-conduits, Universal Head, Meter Cover	667 g (23.53 oz)
J7, J8	Cast SST Universal Head 2-conduits, Standard, Cover	1620 g (57.14 oz)
J7, J8	Cast SST Universal Head 2-conduits, Meter Cover	1730 g (61.02 oz)
R1, R2	Aluminum Connection Head, Standard Cover	523 g (18.45 oz)
R1, R2	Aluminum Connection Head, Meter Cover	618 g (21.79 oz)
R3, R4	Cast SST Connection Head, Standard Cover	1615 g (56.97 oz)
R3, R4	Cast SST Connection Head, Meter Cover	1747 g (61.62 oz)
D1, D2	HART, Field Mount Transmitter, Aluminum Housing, Meter Cover, Standard Cover	1128 g (39.79 oz)

Weight (stainless steel housing for biotechnology, pharmaceutical industries, and sanitary applications)

Option code	Standard cover	Meter cover
S1	840 g (27 oz)	995 g (32 oz)
S2	840 g (27 oz)	995 g (32 oz)
S3	840 g (27 oz)	995 g (32 oz)
S4	840 g (27 oz)	995 g (32 oz)

Enclosure ratings (644H/F)

All available enclosures are Type 4X, IP66, and IP68.

Sanitary housing surface

Surface finish is polished to 32 RMA. Laser etched product marking on housing and standard covers.

Performance specifications

EMC (ElectroMagnetic Compatibility) NAMUR NE 21 Standard

The 644H HART meets the requirements for NAMUR NE 21 Rating.

Susceptibility	Parameter	Influence
		HART
ESD	■ 6 kV contact discharge ■ 8 kV air discharge	None
Radiated	■ 80 – 1000 MHz at 10 V/m AM	< 1.0%
Burst	■ 1 kV for I.O.	None
Surge	■ 0.5 kV line–line ■ 1 kV line–ground (I.O. tool)	None
Conducted	■ 10 kHz to 80 MHz at 10 V	< 1.0%

CE electromagnetic compatibility compliance testing

The 644 is compliant with Directive 2004/108/EC. Meets the criteria under IEC 61326:2006, IEC 61326-2-3:2006.

Power supply effect

Less than ±0.005% of span per volt

Stability

RTDs and thermocouples have a stability of ±0.15% of output reading or 0.15 °C (whichever is greater) for 24 months.

When ordered with the P8 option code:

- RTDs: ±0.25% of reading or 0.25 °C, whichever is greater, for 5 years
- Thermocouples: ±0.5% of reading or 0.5 °C, whichever is greater, for 5 years

Self calibration

The analog-to-digital measurement circuitry automatically self-calibrates for each temperature update by comparing the dynamic measurement to extremely stable and accurate internal reference elements.

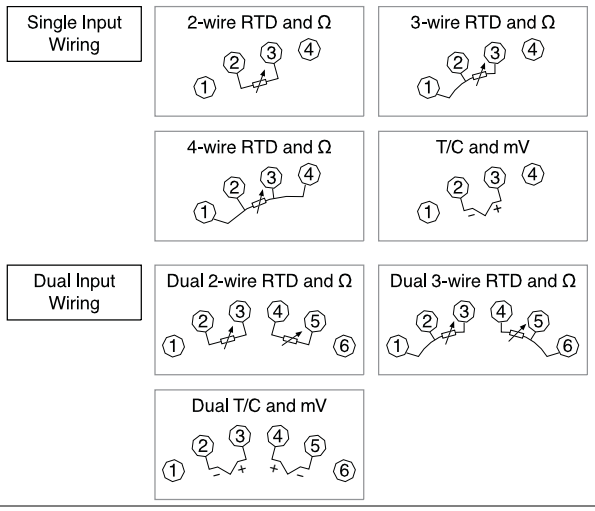
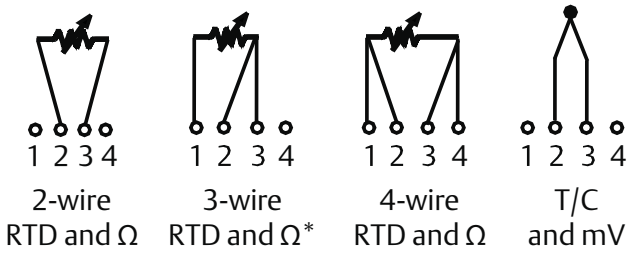
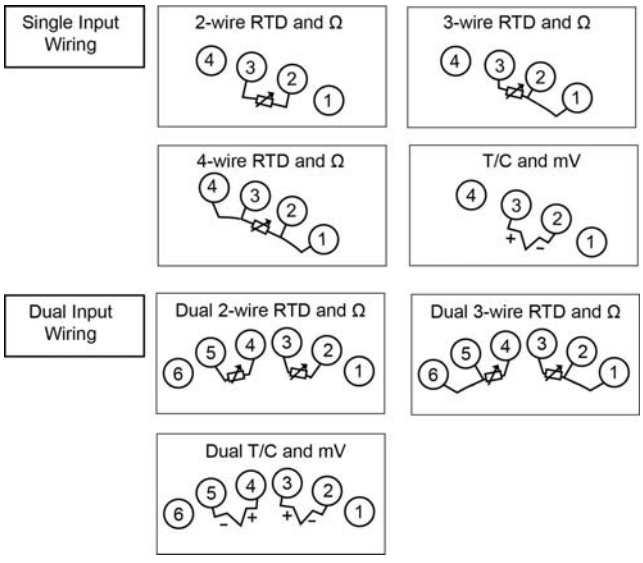
Vibration effect

The 644 HART head mount and field mount are tested to the following specifications with no effect on performance per IEC 60770-1, 2010:

Frequency	Vibration
10 to 60 Hz	0.35 mm displacement
60 to 1000 Hz	5 g (50 m/s^2) peak acceleration

The 644 fieldbus and PROFIBUS are tested to the following specifications with no effect on performance per IEC 60770-1: 1999:

Frequency	Vibration
10 to 60 Hz	0.21 mm displacement
60 to 2000 Hz	3 g peak acceleration

Rosemount 644 Sensor connections diagrams		
Rosemount Inc. provides 4-wire sensors for all single element RTDs. You can use these RTDs in 3-wire configurations by leaving the unneeded leads disconnected and insulated with electrical tape.		
- HART head mount	 	
- HART rail mount - Fieldbus - PROFIBUS	 	
- HART field mount		

FOUNDATION fieldbus specifications

Function blocks

Resource block

- The resource block contains physical transmitter information including available memory, manufacture identification, device type, software tag, and unique identification.

Transducer block

- The transducer block contains the actual temperature measurement data, including sensor 1 and terminal temperature. It includes information about sensor type and configuration, engineering units, linearization, reranging, damping, temperature correction, and diagnostics.

LCD display block

- The LCD display block is used to configure the local display, if an LCD display is being used.

Analog input (AI)

- Processes the measurement and makes it available on the fieldbus segment.
- Allows filtering, alarming, and engineering unit changes.

PID block

- The transmitter provides control functionality with one PID function block in the transmitter. The PID block can be used to perform single loop, cascade, or feedforward control in the field.

Block	Execution time (milliseconds)
Resource	N/A
Transducer	N/A
LCD display Block	N/A
Analog Input 1	45
Analog Input 2	45
PID 1	60

Turn-on time

Performance within specifications in less than 20 seconds after power is applied, when damping value is set to 0 seconds.

Status

If self-diagnostics detect a sensor burnout or a transmitter failure, the status of the measurement will be updated accordingly. Status may also send the AI output to a safe value.

Power supply

Powered over FOUNDATION fieldbus with standard fieldbus power supplies. The transmitter operates between 9.0 and 32.0 Vdc, 12 mA maximum.

Alarms

The AI function block allows the user to configure the alarms to HI-HI, HI, LO, or LO-LO with hysteresis settings.

Backup Link Active Scheduler (LAS)

The transmitter is classified as a device link master, which means it can function as a Link Active Scheduler (LAS) if the current link master device fails or is removed from the segment.
The host or other configuration tool is used to download the schedule for the application to the link master device. In the absence of a primary link master, the transmitter will claim the LAS and provide permanent control for the H1 segment.

FOUNDATION fieldbus parameters

Schedule Entries	25
Links	16
Virtual Communications Relationships (VCR)	12

PROFIBUS PA specifications

Function blocks

Physical block

- The Physical Block contains physical transmitter information including manufacturer identification, device type, software tag, and unique identification.

Transducer block

- The Transducer Block contains the actual temperature measurement data, including sensor 1 and terminal temperature. It includes information about sensor type and configuration, engineering units, linearization, re-ranging, damping, temperature correction, and diagnostics.

Analog input block (AI)

- The Analog Input Block processes the measurement and makes it available on the PROFIBUS segment. Allows filtering, alarming, and engineering unit changes.

Turn-on time

Performance within specifications in less than 20 seconds after power is applied, when damping value is set to 0 seconds.

Power supply

Powered over PROFIBUS with standard fieldbus power supplies. The transmitter operates between 9.0 and 32.0 Vdc,12 mA maximum.

Alarms

The AI function block allows the user to configure the alarms to HI-HI, HI, LO, or LO-LO with hysteresis settings.

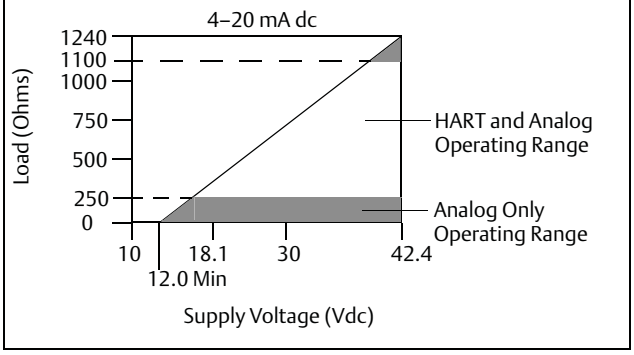
4–20 mA/HART specifications

Power supply

External power supply required. Transmitters operate on 12.0 to 42.4 Vdc transmitter terminal voltage (with 250 ohm load, 18.1 Vdc power supply voltage is required). Transmitter power terminals rated to 42.4 Vdc.

Load limitations

Maximum load = 40.8 X (supply voltage - 12.0)[1]



(1) Without transient protection (optional).

Note
HART Communication requires a loop resistance between 250 and 1100 ohms. Do not communicate with the transmitter when power is below 12 Vdc at the transmitter terminals.

Temperature limits

	Operating limit	Storage limit
With LCD display[1]	–40 to 185 °F –40 to 85 °C	–50 to 185 °F –45 to 85 °C
Without LCD display	–40 to 185 °F –40 to 85 °C	–60 to 248 °F –50 to 120 °C

(1) LCD display may not be readable and display updates will be slower at temperatures below -22 °F (-30 °C).

Hardware and software failure mode

The 644 features software driven alarm diagnostics and an independent circuit which is designed to provide backup alarm output if the microprocessor software fails. The alarm direction (HI/LO) is user-selectable using the failure mode switch. If failure occurs, the position of the switch determines the direction in which the output is driven (HI or LO). The switch feeds into the digital-to-analog (D/A) converter, which drives the proper alarm output even if the microprocessor fails. The values at which the transmitter software drives its output in failure mode depends on whether it is configured to standard, custom, or NAMUR-compliant (NAMUR recommendation NE 43, June 1997) operation. Table 7 shows the configuration alarm ranges.

Table 7. Available Alarm Range[1]

	Standard	NAMUR- NE 43 compliant
Linear Output:	$3.9 \leq I^{(2)} \leq 20.5$	$3.8 \leq I \leq 20.5$
Fail High:	$21.75 \leq I \leq 23$	$21.5 \leq I \leq 23$
Fail Low:	$3.5 \leq I \leq 3.75$	$3.5 \leq I \leq 3.6$

(1) Measured in mA.
(2) I = Process Variable (current output).

Custom alarm and saturation level

Custom factory configuration of alarm and saturation level is available with option code C1 for valid values. These values can also be configured in the field using a Field Communicator.

Turn-on time

Performance within specifications in less than 5.0 seconds after power is applied, when damping value is set to 0 seconds.

External transient protection

The Rosemount 470 Transient Protector prevents damage from transients induced by lightning, welding, or heavy electrical equipment. For more information, refer to the Rosemount 470 Transient Protector Product Data Sheet (document number 00813-0100-4191).

Transient protection (option code T1)

The transient protector helps to prevent damage to the transmitter from transients induced on the loop wiring by lightning, welding, heavy electrical equipment, or switch gears. The transient protection electronics are contained in an add-on assembly that attaches to the standard transmitter terminal block. The external ground lug assembly (code G1) is included with the Transient Protector. The transient protector has been tested per the following standard:

- IEEE C62.41-1991 (IEEE 587)/ Location Categories B3. 6kV/3kA peak (1.2 50 Ωs Wave 8 20 Ωs Combination Wave) 6kV/0.5kA peak (100 kHz Ring Wave) EFT, 4kVpeak, 2.5kHz, 5*50nS
- Loop resistance added by protector: 22 ohms max.
- Nominal clamping voltages: 90 V (common mode), 77 V (normal mode)

Accuracy

Table 8. Rosemount 644 Transmitter Accuracy

Sensor options	Sensor reference	Input ranges		Recommended min. span[1]		Digital accuracy[2]		D/A accuracy[3]
2-, 3-, 4-wire RTDs		°C	°F	°C	°F	°C	°F	
Pt 100 (α = 0.00385)	IEC 751	–200 to 850	–328 to 1562	10	18	± 0.15	± 0.27	±0.03% of span
Pt 200 (α = 0.00385)	IEC 751	–200 to 850	–328 to 1562	10	18	± 0.15	± 0.27	±0.03% of span
Pt 500 (α = 0.00385)	IEC 751	–200 to 850	–328 to 1562	10	18	± 0.19	± 0.34	±0.03% of span
Pt 1000 (α = 0.00385)	IEC 751	–200 to 300	–328 to 572	10	18	± 0.19	± 0.34	±0.03% of span
Pt 100 (α = 0.003916)	JIS 1604	–200 to 645	–328 to 1193	10	18	± 0.15	± 0.27	±0.03% of span
Pt 200 (α = 0.003916)	JIS 1604	–200 to 645	–328 to 1193	10	18	± 0.27	± 0.49	±0.03% of span
Ni 120	Edison Curve No. 7	–70 to 300	–94 to 572	10	18	± 0.15	± 0.27	±0.03% of span
Cu 10	Edison Copper Winding No. 15	–50 to 250	–58 to 482	10	18	±1.40	± 2.52	±0.03% of span
Pt 50 (α = 0.00391)	GOST 6651-94	–200 to 550	–328 to 1022	10	18	± 0.30	± 0.54	±0.03% of span
Pt 100 (α = 0.00391)	GOST 6651-94	–200 to 550	–328 to 1022	10	18	± 0.15	± 0.27	±0.03% of span
Cu 50 (α = 0.00426)	GOST 6651-94	–50 to 200	–58 to 392	10	18	±1.34	± 2.41	±0.03% of span
Cu 50 (α = 0.00428)	GOST 6651-94	–185 to 200	–301 to 392	10	18	±1.34	± 2.41	±0.03% of span
Cu 100 (α = 0.00426)	GOST 6651-94	–50 to 200	–58 to 392	10	18	±0.67	± 1.20	±0.03% of span
Cu 100 (α = 0.00428)	GOST 6651-94	–185 to 200	–301 to 392	10	18	±0.67	± 1.20	±0.03% of span
Thermocouples[4]								
Type B[5]	NIST Monograph 175, IEC 584	100 to 1820	212 to 3308	25	45	± 0.77	± 1.39	±0.03% of span
Type E	NIST Monograph 175, IEC 584	–200 to 1000	–328 to 1832	25	45	± 0.20	± 0.36	±0.03% of span
Type J	NIST Monograph 175, IEC 584	–180 to 760	–292 to 1400	25	45	± 0.35	± 0.63	±0.03% of span
Type K[6]	NIST Monograph 175, IEC 584	–180 to 1372	–292 to 2501	25	45	± 0.50	± 0.90	±0.03% of span
Type N	NIST Monograph 175, IEC 584	–200 to 1300	–328 to 2372	25	45	± 0.50	± 0.90	±0.03% of span
Type R	NIST Monograph 175, IEC 584	0 to 1768	32 to 3214	25	45	± 0.75	± 1.35	±0.03% of span
Type S	NIST Monograph 175, IEC 584	0 to 1768	32 to 3214	25	45	± 0.70	± 1.26	±0.03% of span
Type T	NIST Monograph 175, IEC 584	–200 to 400	–328 to 752	25	45	± 0.35	± 0.63	±0.03% of span
DIN Type L	DIN 43710	–200 to 900	–328 to 1652	25	45	± 0.35	± 0.63	±0.03% of span
DIN Type U	DIN 43710	–200 to –600	–328 to 1112	25	45	± 0.35	± 0.63	±0.03% of span
Type W5Re/W26Re	ASTM E 988-96	0 to 2000	32 to 3632	25	45	± 0.70	± 1.26	±0.03% of span
GOST Type L	GOST R 8.585-2001	–200 to 800	–328 to 1472	25	45	± 1.00	± 1.26	±0.03% of span
Other input types								
Millivolt Input		–10 to 100 mV				±0.015 mV		±0.03% of span
2-, 3-, 4-wire Ohm Input		0 to 2000 ohms				±0.45 ohm		±0.03% of span

(1) No minimum or maximum span restrictions within the input ranges. Recommended minimum span will hold noise within accuracy specification with damping at zero seconds.
(2) The published digital accuracy applies over the entire sensor input range. Digital output can be accessed by HART or FOUNDATION fieldbus Communications or Rosemount control system.
(3) Total Analog accuracy is the sum of digital and D/A accuracies. This is not applicable for FOUNDATION fieldbus.
(4) Total digital accuracy for thermocouple measurement: sum of digital accuracy +0.5 °C. (cold junction accuracy).
(5) Digital accuracy for NIST Type B T/C is ±3.0 °C (±5.4 °F) from 100 to 300 °C (212 to 572 °F).
(6) Digital accuracy for NIST Type K T/C is ±0.70 °C (±1.26 °F) from –180 to –90 °C (–292 to –130 °F).

Accuracy example (HART devices)

When using a Pt 100 (α = 0.00385) sensor input with a 0 to 100 °C span:

- Digital accuracy = ±0.15 °C
- D/A accuracy = ±0.03% of 100 °C or ±0.03 °C
- Total accuracy = ±0.18 °C

Accuracy example (FOUNDATION fieldbus and PROFIBUS PA devices)

When using a Pt 100 (α = 0.00385) sensor input:

- Total accuracy = ±0.15 °C
- No D/A accuracy effects apply.

Table 9. Ambient temperature effect

Sensor options	Sensor reference	Input range (°C)	Temperature effects per 1.0 °C (1.8 °F) change in ambient temperature[1][2]	Range	D/A effect[3]
2-, 3-, 4-wire RTDs					
Pt 100 (α = 0.00385)	IEC 751	-200 to 850	0.003 °C (0.0054 °F)	Entire Sensor Input Range	0.001% of span
Pt 200 (α = 0.00385)	IEC 751	-200 to 850	0.004 °C (0.0072 °F)	Entire Sensor Input Range	0.001% of span
Pt 500 (α = 0.00385)	IEC 751	-200 to 850	0.003 °C (0.0054 °F)	Entire Sensor Input Range	0.001% of span
Pt 1000 (α = 0.00385)	IEC 751	-200 to 300	0.003 °C (0.0054 °F)	Entire Sensor Input Range	0.001% of span
Pt 100 (α = 0.003916)	JIS 1604	-200 to 645	0.003 °C (0.0054 °F)	Entire Sensor Input Range	0.001% of span
Pt 200 (α = 0.003916)	JIS 1604	-200 to 645	0.004 °C (0.0072 °F)	Entire Sensor Input Range	0.001% of span
Ni 120	Edison Curve No. 7	-70 to 300	0.003 °C (0.0054 °F)	Entire Sensor Input Range	0.001% of span
Cu 10	Edison Copper Winding No. 15	-50 to 250	0.03 °C (0.054 °F)	Entire Sensor Input Range	0.001% of span
Pt 50 (α = 0.00391)	GOST 6651-94	-200 to 550	0.004 °C (0.0072 °F)	Entire Sensor Input Range	0.001% of span
Pt 100 (α = 0.00391)	GOST 6651-94	-200 to 550	0.003 °C (0.0054 °F)	Entire Sensor Input Range	0.001% of span
Cu 50 (α = 0.00426)	GOST 6651-94	-50 to 200	0.008 °C (0.0144 °F)	Entire Sensor Input Range	0.001% of span
Cu 50 (α = 0.00428)	GOST 6651-94	-185 to 200	0.008 °C (0.0144 °F)	Entire Sensor Input Range	0.001% of span
Cu 100 (α = 0.00426)	GOST 6651-94	-50 to 200	0.004 °C (0.0072 °F)	Entire Sensor Input Range	0.001% of span
Cu 100 (α = 0.00428)	GOST 6651-94	-185 to 200	0.004 °C (0.0072 °F)	Entire Sensor Input Range	0.001% of span
Thermocouples					
Type B	NIST Monograph 175, IEC 584	100 to 1820	0.014 °C	T ≥ 1000 °C	0.001% of span
			0.032 °C – (0.0025% of (T – 300))	300 °C ≤ T < 1000 °C	0.001% of span
			0.054 °C – (0.011% of (T – 100))	100 °C ≤ T < 300 °C	0.001% of span
Type E	NIST Monograph 175, IEC 584	-200 to 1000	0.005 °C + (0.0043% of T)	All	0.001% of span
Type J	NIST Monograph 175, IEC 584	-180 to 760	0.0054 °C + (0.00029%of T)	T ≥ 0 °C	0.001% of span
			0.0054 °C + (0.0025% of absolute value T)	T < 0 °C	0.001% of span
Type K	NIST Monograph 175, IEC 584	-180 to 1372	0.0061 °C + (0.0054% of T)	T ≥ 0 °C	0.001% of span
			0.0061 °C + (0.0025% of absolute value T)	T < 0 °C	0.001% of span
Type N	NIST Monograph 175, IEC 584	-200 to 1300	0.0068 °C + (0.00036% of T)	All	0.001% of span
Type R	NIST Monograph 175, IEC 584	0 to 1768	0.016 °C	T ≥ 200 °C	0.001% of span
			0.023 °C – (0.0036% of T)	T < 200 °C	0.001% of span
Type S	NIST Monograph 175, IEC 584	0 to 1768	0.016 °C	T ≥ 200 °C	0.001% of span
			0.023 °C – (0.0036% of T)	T < 200 °C	0.001% of span
Type T	NIST Monograph 175, IEC 584	-200 to 400	0.0064 °C	T ≥ 0 °C	0.001% of span
			0.0064 °C +(0.0043% of absolute value T)	T < 0 °C	0.001% of span
DIN Type L	DIN 43710	-200 to 900	0.0054 °C + (0.00029% of T)	T ≥ 0 °C	0.001% of span
			0.0054 °C + (0.0025% of absolute value T)	T < 0 °C	0.001% of span
DIN Type U	DIN 43710	-200 to 600	0.0064 °C	T ≥ 0 °C	0.001% of span
			0.0064 °C + (0.0043% of absolute value T)	T < 0 °C	0.001% of span

Table 9. Ambient temperature effect

Sensor options	Sensor reference	Input range (°C)	Temperature effects per 1.0 °C (1.8 °F) change in ambient temperature[1][2]	Range	D/A effect[3]
Type W5Re/W26Re	ASTM E 988-96	0 to 2000	0.016 °C	T ≥ 200 °C	0.001% of span
			0.023 °C – (0.0036% of T)	T < 200 °C	0.001% of span
GOST Type L	GOST R 8.585-2001	-200 to 800	0.007 °C	T ≥ 0 °C	0.001% of span
			0.007 °C – (0.003% of absolute value T)	T < 0 °C	0.001% of span
Other input types					
Millivolt Input		-10 to 100 mV	0.0005 mV	Entire Sensor Input Range	0.001% of span
2-, 3-, 4-wire Ohm		0 to 2000 Ω	0.0084 Ω	Entire Sensor Input Range	0.001% of span

(1) Change in ambient is with reference to the calibration temperature of the transmitter 68 °F (20 °C) from factory.
(2) Ambient temperature effect specification valid over minimum temperature span of 28°C (50°F).
(3) Does not apply to FOUNDATION fieldbus.

Temperature effects example (HART devices)

When using a Pt 100 (α = 0.00385) sensor input with a 0–100 °C span at 30 °C ambient temperature:

- Digital Temperature Effects: 0.003 °C x (30 - 20) = 0.03 °C
- D/A Effects: [0.001% of 100] x (30 - 20) = 0.01 °C
- Worst Case Error: Digital + D/A + Digital Temperature Effects + D/A Effects = 0.15 °C + 0.03 °C + 0.03 °C + 0.01 °C = 0.22 °C
- Total Probable Error: $\sqrt{0.15^2 + 0.03^2 + 0.03^2 + 0.01^2} = 0.16°C$

Temperature effects examples (FOUNDATION fieldbus devices and PROFIBUS PA)

When using a Pt 100 (α = 0.00385) sensor input at 30 °C span at 30 °C ambient temperature:

- Digital Temperature Effects: 0.003 °C x (30 - 20) = 0.03 °C
- D/A Effects: No D/A effects apply.
- Worst Case Error: Digital + Digital Temperature Effects = 0.15 °C + 0.03 °C = 0.18 °C
- Total Probable Error: $\sqrt{0.15^2 + 0.03^2} = 0.153°C$

Table 10. Transmitter Accuracy when Ordered with Option Code P8

Sensor options	Sensor reference	Input ranges		Minimum span[1]		Digital accuracy[2]		D/A accuracy[3][4]
2-, 3-, 4-wire RTDs		°C	°F	°C	°F	°C	°F	
Pt 100 (α = 0.00385)	IEC 751	–200 to 850	–328 to 1562	10	18	± 0.10	± 0.18	±0.02% of span
Pt 200 (α = 0.00385)	IEC 751	–200 to 850	–328 to 1562	10	18	± 0.22	± 0.40	±0.02% of span
Pt 500 (α = 0.00385)	IEC 751	–200 to 850	–328 to 1562	10	18	± 0.14	± 0.25	±0.02% of span
Pt 1000 (α = 0.00385)	IEC 751	–200 to 300	–328 to 572	10	18	± 0.10	± 0.18	±0.02% of span
Pt 100 (α = 0.003916)	JIS 1604	–200 to 645	–328 to 1193	10	18	± 0.10	± 0.18	±0.02% of span
Pt 200 (α = 0.003916)	JIS 1604	–200 to 645	–328 to 1193	10	18	± 0.22	± 0.40	±0.02% of span
Ni 120	Edison Curve No. 7	–70 to 300	–94 to 572	10	18	± 0.08	± 0.14	±0.02% of span
Cu 10	Edison Copper Winding No. 15	–50 to 250	–58 to 482	10	18	±1.00	± 1.80	±0.02% of span
Pt 50 (α=0.00391)	GOST 6651-94	–200 to 550	–328 to 1022	10	18	±0.20	±0.36	±0.02% of span
Pt 100 (α=0.00391)	GOST 6651-94	–200 to 550	–328 to 1022	10	18	±0.10	±0.18	±0.02% of span
Cu 50 (α=0.00426)	GOST 6651-94	–50 to 200	–58 to 392	10	18	±0.34	±0.61	±0.02% of span

Table 10. Transmitter Accuracy when Ordered with Option Code P8

Sensor options	Sensor reference	Input ranges		Minimum span[5]		Digital accuracy[6]		D/A accuracy[7][8]
2-, 3-, 4-wire RTDs		°C	°F	°C	°F	°C	°F	
Cu 50 (α=0.00428)	GOST 6651-94	–185 to 200	–301 to 392	10	18	±0.34	±0.61	±0.02% of span
Cu 100 (α=0.00426)	GOST 6651-94	–50 to 200	–58 to 392	10	18	±0.17	±0.31	±0.02% of span
Cu 100 (α=0.00428)	GOST 6651-94	–185 to 200	–301 to 392	10	18	±0.17	±0.31	±0.02% of span
Thermocouples[9]								
Type B[10]	NIST Monograph 175, IEC 584	100 to 1820	212 to 3308	25	45	± 0.75	± 1.35	±0.02% of span
Type E	NIST Monograph 175, IEC 584	–200 to 1000	–328 to 1832	25	45	± 0.20	± 0.36	±0.02% of span
Type J	NIST Monograph 175, IEC 584	–180 to 760	–292 to 1400	25	45	± 0.25	± 0.45	±0.02% of span
Type K[11]	NIST Monograph 175, IEC 584	–180 to 1372	–292 to 2501	25	45	± 0.25	± 0.45	±0.02% of span
Type N	NIST Monograph 175, IEC 584	–200 to 1300	–328 to 2372	25	45	± 0.40	± 0.72	±0.02% of span
Type R	NIST Monograph 175, IEC 584	0 to 1768	32 to 3214	25	45	± 0.60	± 1.08	±0.02% of span
Type S	NIST Monograph 175, IEC 584	0 to 1768	32 to 3214	25	45	± 0.50	± 0.90	±0.02% of span
Type T	NIST Monograph 175, IEC 584	–200 to 400	–328 to 752	25	45	± 0.25	± 0.45	±0.02% of span
DIN Type L	DIN 43710	–200 to 900	–328 to 1652	25	45	± 0.35	± 0.63	±0.02% of span
DIN Type U	DIN 43710	–200 to 600	–328 to 1112	25	45	± 0.35	± 0.63	±0.02% of span
Type W5Re/W26Re	ASTM E 988-96	0 to 2000	32 to 3632	25	45	± 0.70	± 1.26	±0.02% of span
GOST Type L	GOST R 8.585-2001	–200 to 800	–392 to 1472	25	45	± 0.25	± 0.45	±0.02% of span
Other input types								
Millivolt Input		–10 to 100 mV		3 mV		±0.015 mV		±0.02% of span
2-, 3-, 4-wire Ohm Input		0 to 2000 ohms		20 ohm		±0.35 ohm		±0.02% of span

(1) No minimum or maximum span restrictions within the input ranges. Recommended minimum span will hold noise within accuracy specification with damping at zero seconds.
(2) Digital accuracy: Digital output can be accessed by the Field Communicator.
(3) Total Analog accuracy is the sum of digital and D/A accuracies.
(4) Applies to HART/4-20 mA devices.
(5) No minimum or maximum span restrictions within the input ranges. Recommended minimum span will hold noise within accuracy specification with damping at zero seconds.
(6) Digital accuracy: Digital output can be accessed by the Field Communicator.
(7) Total Analog accuracy is the sum of digital and D/A accuracies.
(8) Applies to HART/4-20 mA devices.
(9) Total digital accuracy for thermocouple measurement: sum of digital accuracy +0.25 °C (0.45 °F) (cold junction accuracy).
(10) Digital accuracy for NIST Type B is ±3.0 °C (±5.4 °F) from 100 to 300 °C (212 to 572 °F).
(11) Digital accuracy for NIST Type K is ±0.50 °C (±0.9 °F) from –180 to –90 °C (–292 to –130 °F).

Reference accuracy example (HART only)

When using a Pt 100 (α = 0.00385) sensor input with a 0 to 100 °C span: Digital Accuracy would be ±0.10 °C, D/A accuracy would be ±0.02% of 100 °C or ±0.02 °C, Total = ±0.12 °C.

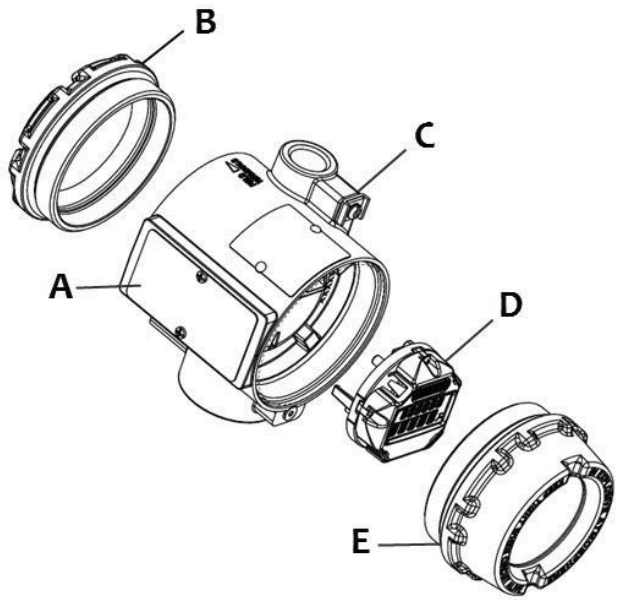
Differential capability exists between any two sensor types (dual-sensor option)

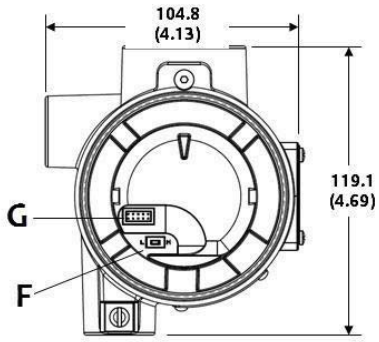
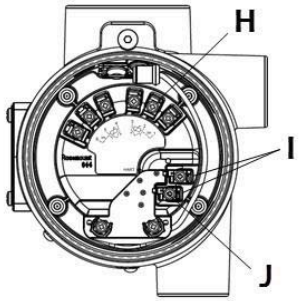
For all differential configurations, the input range is X to Y where:

- X = Sensor 1 minimum – Sensor 2 maximum
  and
- Y = Sensor 1 maximum – Sensor 2 minimum

644 Field Mount

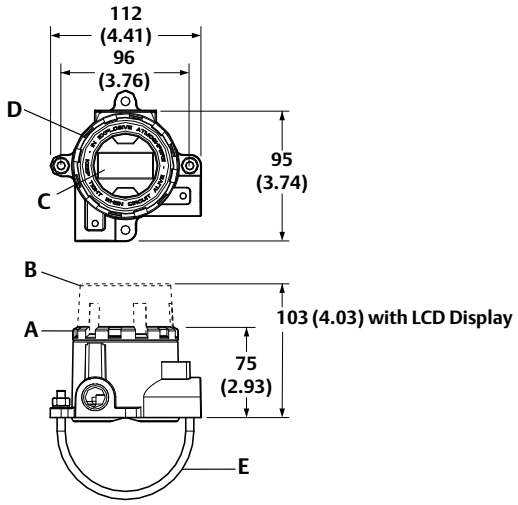
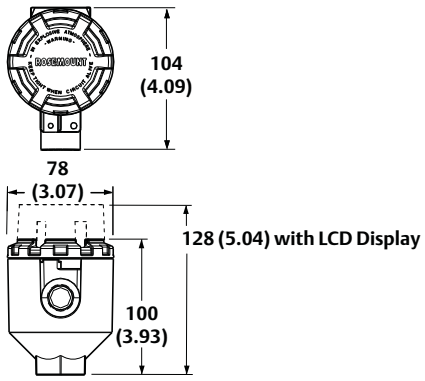
Transmitter exploded view



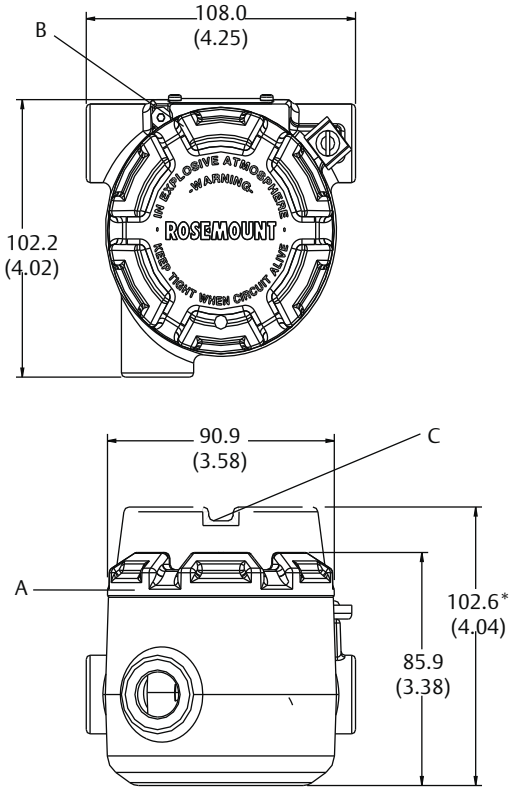
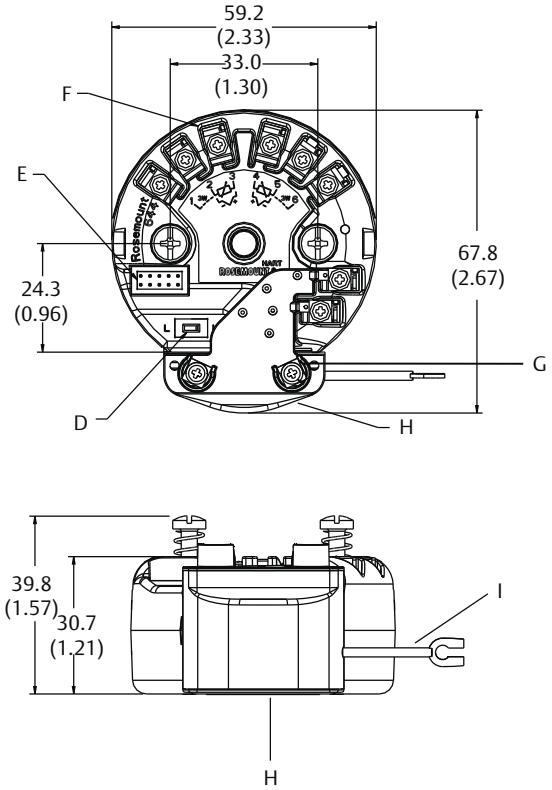
Display compartment	Terminal compartment with optional transient protector
	

A. Nameplate B. Cover C. Housing with Electronics Module D. LCD Display E. Display Cover	F. Failure Mode Switch G. Display Connection H. Sensor Terminals I. Communication Terminals J. Power Terminals

Dimensions are in millimeters (inches).

Threaded-sensor universal head (option code J5, J6, J7 or J8)	DIN style sensor connection head (option code R1, R2, R3 or R4)
	
A. Standard Cover B. Display Cover C. LCD Display	D. Label E. 316 SST “U” Bolt Mounting, 2-inch Pipe (shipped with each head unless assembly option XA is ordered)

Dimensions are in millimeters (inches).

Threaded sensor universal head, 3-conduit (option code J1 or J2)	Rosemount 644 with transient protector (option code T1)
	
A. Standard Cover B. Label C. Display Cover D. Failure Mode Switch E. Display Connection	F. Sensor Terminals G. Power Terminals H. Transient Protector I. Ground Wire
* **with LCD cover** **Note:** Option code T1 requires the use of J1, J2, J3 or J4 enclosure option.	

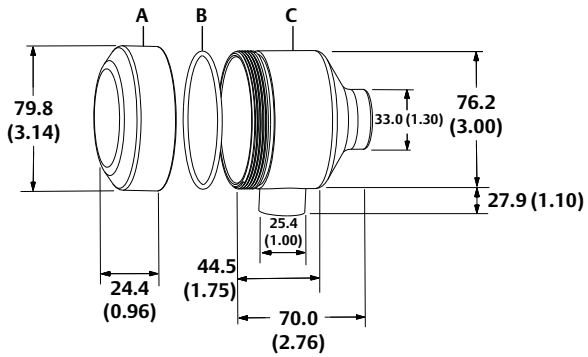
Dimensions are in millimeters (inches).

Accessory dimensional drawings

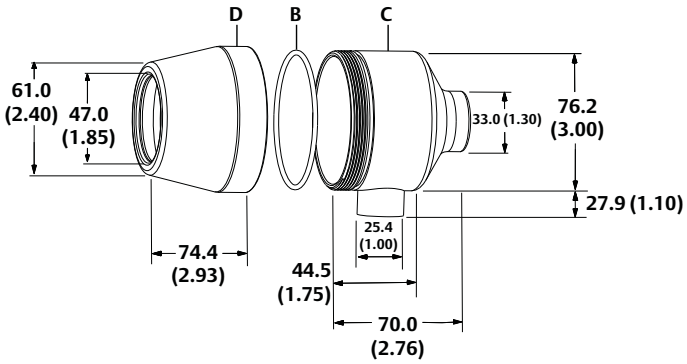
Stainless steel housing for biotechnology, pharmaceutical industries, and sanitary applications

Sanitary housing (Option Code S1, S2, S3, S4)

Standard cover



LCD display cover

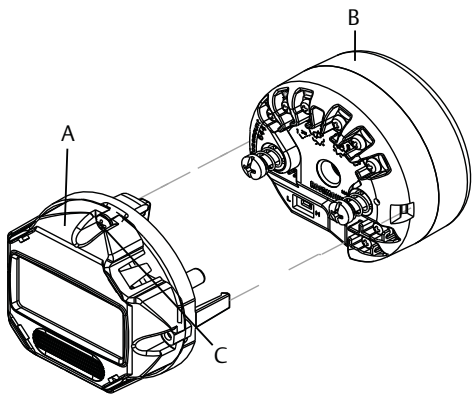


A. Standard Cover
B. O-Ring
C. Housing
D. LCD Display Cover

Dimensions are in millimeters (inches).

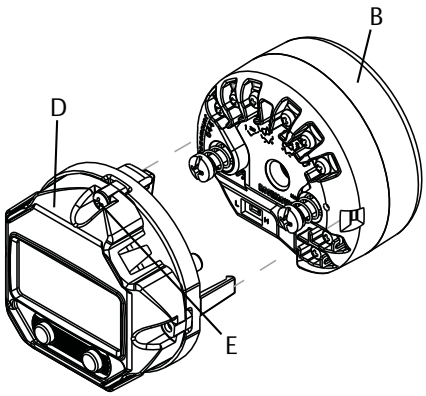
Display drawings

LCD display



A. LCD Display
B. 644 Transmitter
C. Display Rotation

Enhanced display with local operator interface

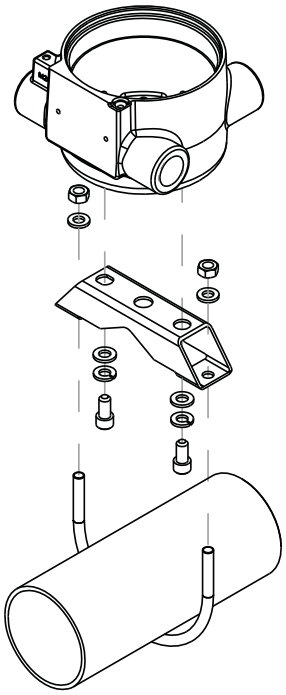


D. LCD Display with LOI
E. Display Rotation Screws

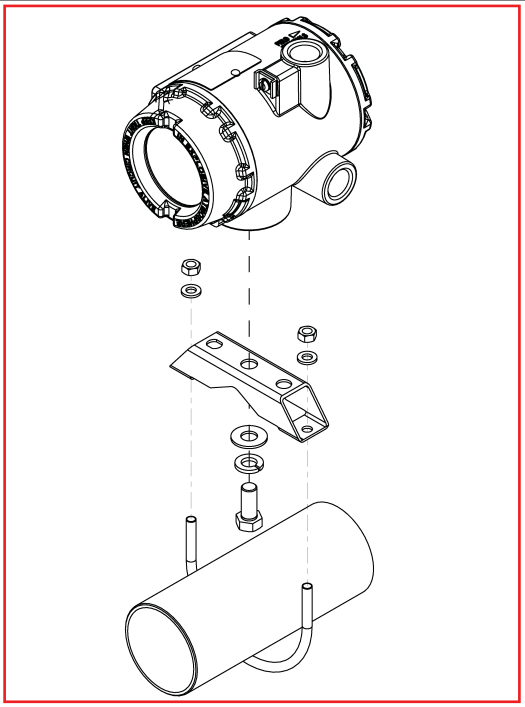
Optional mounting

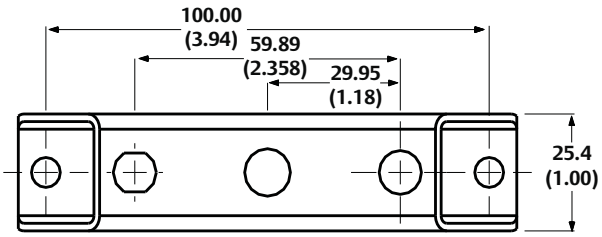
Optional transmitter mounting brackets

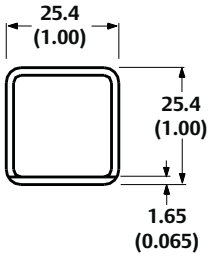
Option code B4 bracket for enclosures J1, J2, J3, and J4

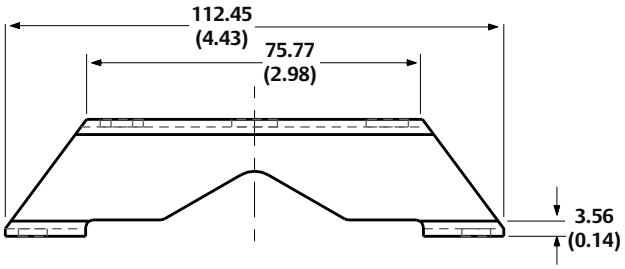


Option code B4 bracket for enclosures D1 and D2



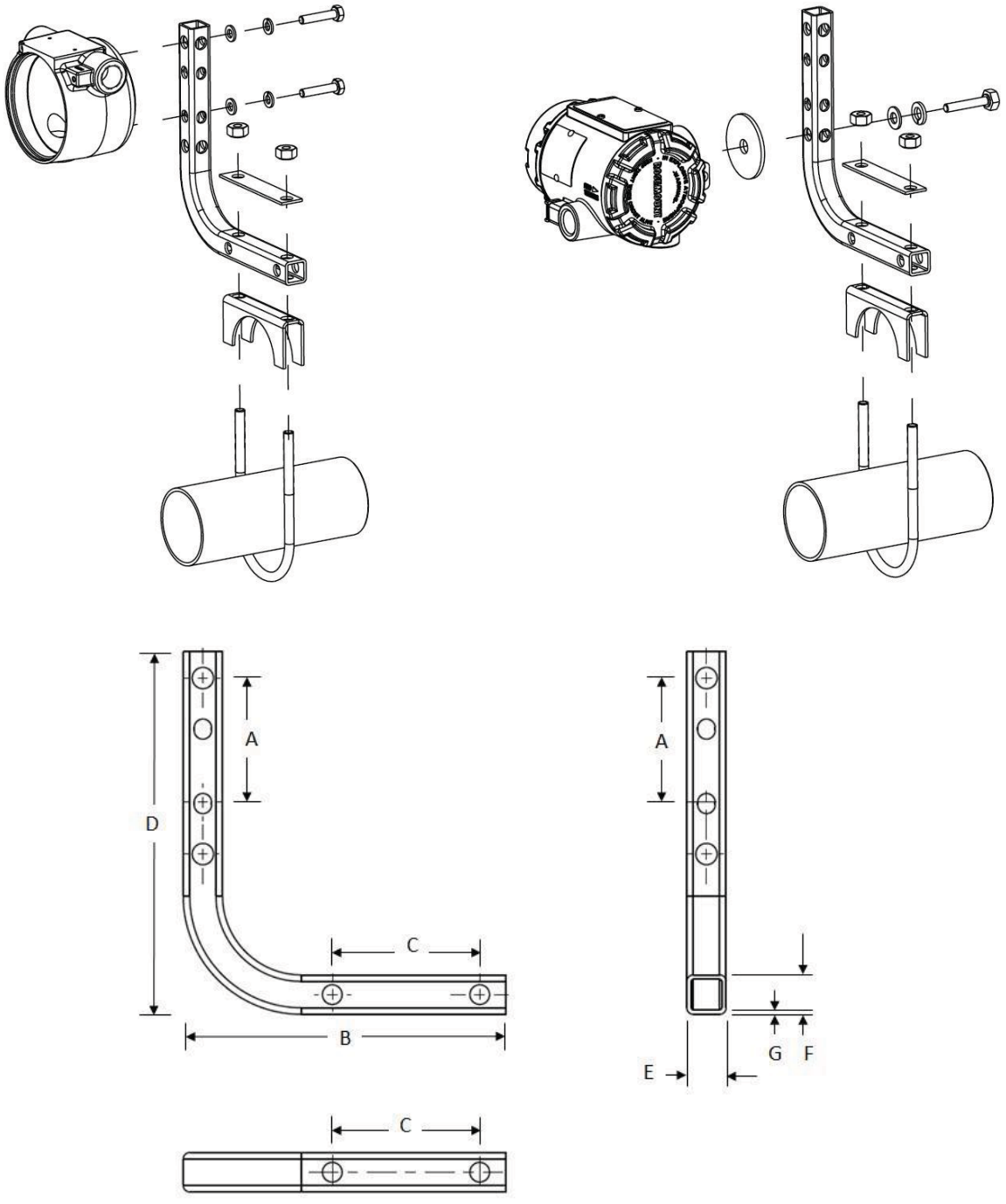






Dimensions are in millimeters (inches).

Option code B5 bracket for enclosures J1, J2, J3, and J4	Option code B5 bracket for enclosures D1 and D2



A. 59.89(2.358)
B. 156.2 (6.15)
C. 71.4 (2.81)
D. 175.3 (6.9)
E. 19.05 (0.75)
F. 19.05 (0.75)
G. 2.11 (0.083)

Dimensions are in millimeters (inches).

Configuration

Transmitter configuration

The transmitter is available with standard configuration setting for either HART (see Standard HART configuration), FOUNDATION fieldbus (see Standard Foundation fieldbus configuration) or PROFIBUS PA (see Standard PROFIBUS PA configuration). The configuration settings and block configuration may be changed in the field with Emerson's DeltaV™, AMS® Suite, handheld Field Communicator or other host or configuration tool.

Standard HART configuration

Unless specified, the transmitter will be shipped as follows:

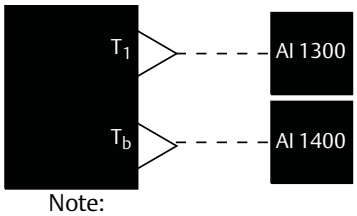
Sensor Type	RTD, Pt 100 (α=0.00385, 4-wire)
4 mA Value	0 °C
20 mA Value	100 °C
Output	Linear with temperature
Saturation Levels	3.9 / 20.5 mA
Damping	5 sec.
Line Voltage Filter	50 Hz
Alarm	High (21.75 mA)
LCD display (when installed)	Engineering Units and mA
Tag	See "Tagging" on page 11.

Standard FOUNDATION fieldbus configuration

Unless otherwise specified, the transmitter will be shipped as follows:

Sensor Type: RTD, Pt 100 (α=0.00385, 4-wire)
Damping: 5 sec.
Units of Measurement: °C
Line Voltage Filter: 50 Hz
Software Tag: See "Tagging" on page 11
Function Block Tags: • Resource Block: Resource • Transducer Block: Transducer • LCD display Block: LCD display • Analog Input Blocks: AI 1300, AI 1400 • PID Block: PID 1500
Alarm Limits of AI 1300, AI 1400 • HI-HI: Infinity • HI: Infinity • LO: Infinity • LO-LO: Infinity
Local Display (when installed): Engineering Units of Temperature

Standard block configuration



Note:
T_1 = Sensor Temperature
T_b = Terminal Temperature

Final station

AI Blocks are scheduled for 1 second. AI Blocks are linked as shown above.

Standard PROFIBUS PA configuration

Unless specified, the transmitter will be shipped as follows:

Device Address: 126
Sensor Type: RTD, Pt 100 (α=0.00385, 4-wire)
Damping: 5 sec.
Units of Measurement: °C
Line Voltage Filter: 50 Hz
Software Tag: See "Tagging" on page 11.
Alarm Limits: • HI-HI: Infinity • HI: Infinity • LO: - Infinity • LO-LO: Infinity
Local Display (when installed): Engineering Units of Temperature

Custom configuration

Custom configurations are to be specified when ordering. This configuration must be the same for all sensors. The following table lists the necessary requirements to specify a custom configuration.

	Option code	Customization available
HART	**C1**: Factory Configuration Data (CDS required) Also needs option code: **...DC** **...DC** **...M4 or M5**	■ **Date**: day/month/year ■ **Descriptor**: 8 alphanumeric characters ■ **Message**: 32 alphanumeric characters ■ **Hardware Tag**: 13 Characters ■ **Software Tag**: 8 Characters ■ Sensor Type and Connection ■ Measurement Range and Units ■ Damping Value ■ **Failure Mode:** High or Low ■ **Hot Backup:** Mode and PV ■ **Sensor Drift Alert:** Mode, Limit and Units ■ **Display Configuration**: Choose what will be shown on the LCD display ■ **Custom Alarm and saturation levels**: Choose custom High and Low Alarm and Saturation levels ■ **Security information:** Write Protection, HART Lock and Local Operator Interface Password
	C2:Transmitter – Sensor Matching	■ The transmitters are designed to accept Callendar-Van Dusen constants from a calibrated RTD. Using these constants, the transmitter generates a custom curve to match the sensor-specific curve. Specify a Series 65, 65, or 78 RTD sensor on the order with a special characterization curve (V or X8Q4 option). These constants will be programmed into the transmitter with this option.
	A1, CN, or C8: Alarm Level Configuration	■ **A1:** NAMUR Alarm and Saturation Levels, with High Alarm configured ■ **CN:** NAMUR Alarm and Saturation Levels, with Low Alarm configured ■ **C8:** Low Alarm (Standard Rosemount Alarm and Saturation Values)
	Q4: Three-Point Calibration with Certificate	■ Calibration certificate. Three-Point calibration at 0, 50 and 100% with certificate.
	C4: Five-Point Calibration	■ Will include five-point calibration at 0, 25, 50, 75, and 100% analog and digital output points. Use with Calibration Certificate Q4
	HR7: HART Revision configuration	■ Your 644 Head mount and Field mount are HART revision selectable. Order the HR7 code to configure your device to operate in HART Revision 7 mode. Your device is also configurable in the field. Refer to the 644 Quick Start Guide or Reference Manual for more instructions. ■ **Long Software Tag:** 32 Characters

	Option code	Requirements/specification
FOUNDATION fieldbus	C1: Factory Configuration Data (CDS required)	Date: day/month/year Descriptor: 16 alphanumeric characters Message: 32 alphanumeric characters
	C2:Transmitter – Sensor Matching	The transmitters are designed to accept Callendar-Van Dusen constants from a calibrated RTD. Using these constants, the transmitter generates a custom curve to match the sensor-specific curve. Specify a Series 65, 65, or 78 RTD sensor on the order with a special characterization curve (V or X8Q4 option). These constants will be programmed into the transmitter with this option.
	C4: Five-Point Calibration	Will include five-point calibration at 0, 25, 50, 75, and 100% analog and digital output points. Use with Calibration Certificate Q4.
	Q4: Three-Point Calibration with Certificate	Calibration certificate. Three-Point calibration with certificate.

	Option code	Requirements/specification
PROFIBUS PA	C1: Factory Configuration Data (CDS required)	Date: day/month/year Descriptor: 16 alphanumeric characters Message: 32 alphanumeric characters
	C2:Transmitter – Sensor Matching	The transmitters are designed to accept Callendar-Van Dusen constants from a calibrated RTD. Using these constants, the transmitter generates a custom curve to match the sensor-specific curve. Specify a Series 65, or 78 RTD sensor on the order with a special characterization curve (V or X8Q4 option). These constants will be programmed into the transmitter with this option.
	C4: Five-Point Calibration	Will include five-point calibration at 0, 25, 50, 75, and 100% analog and digital output points. Use with Calibration Certificate Q4.
	Q4: Three-Point Calibration with Certificate	Calibration certificate. Three-Point calibration with certificate.

Specifications and Reference Data for 644 HART (Device Revision 7 or Previous)

Functional specifications

Inputs
User-selectable; sensor terminals rated to 42.4 Vdc. See "Accuracy" on page 20 for sensor options.

Output
Single 2-wire device with either 4-20 mA/HART, linear with temperature or input. Device supports protocol revision HART 5.

Isolation
Input/output isolation tested to 600 Vrms.

Local display
The optional five-digit integral LCD display includes a floating or fixed decimal point. It can also display engineering units (°F, °C, °R, K, Ω, and mV), mA, and percent of span. The display can be configured to alternate between selected display options. Display settings are preconfigured at the factory according to the standard transmitter configuration. They can be reconfigured in the field using a compliant field communicator.

Humidity limits
0–95% relative humidity

Update time
≤ 0.5 sec.

Accuracy (default configuration) PT 100
HART (0-100 °C): ±0.18 °C

Table 11. 644 HART legacy display kits

	Kit part number
Display Only	00644-4430-0002
Display and Aluminum, Housing Cover(1)	00644-4430-0001
Display and SST Housing Cover(1)	00644-4430-0011

(1) Covers provided are compatible with the 3 in (76mm) Universal Junction Box and Rosemount Connection Head enclosure styles.

Physical specifications

Electrical connections

Model	Power and sensor terminals
644H	Compression screws permanently fixed to terminal block

Field communicator connections

Communication terminals	
644H	Clips permanently fixed to terminal block

Materials of construction

Electronics housing and terminal block	
644H	GE polyphenylene oxide glass reinforced
Enclosure (options J5, J6)	
Housing	Low-copper aluminum
Paint	Polyurethane
Cover O-ring	Buna-N

Materials of constructions (stainless steel housing for biotechnology, pharmaceutical industries, and sanitary applications)
Housing and Standard Meter Cover
- 316 SST

Cover O-Ring
- Buna-N

Mounting
The 644H installs in a connection head or universal head mounted directly on a sensor assembly, apart from a sensor assembly using a universal head, or to a DIN rail using an optional mounting clip.

Special mounting considerations
See "Mounting kits for 644H" on page 26 for the special hardware that is available to:

- Mount a 644H to a DIN rail. (see page 24)
- Retrofit a new 644H to replace an existing 644H Transmitter in an existing threaded sensor connection head.(see Table 3 on page 11)

Weight

Code	Options	Weight
644H	HART, Head Mount Transmitter	95 g (3.39 oz)
644H	FOUNDATION fieldbus, Head Mount Transmitter	92 g (3.25 oz)
644H	PROFIBUS PA Head Mount Transmitter	92 g (3.25 oz)
644R	HART, Rail Mount Transmitter	174 g (6.14 oz)
M5	LCD Display	35 g (1.34 oz)
J5, J6	Universal Head, Standard Cover	577 g (20.35 oz)
J5, J6	Universal Head, Meter Cover	667 g (23.53 oz)
J7, J8	SST Universal Head, Std. Cover	1620 g (57.14 oz)
J7, J8	SST Universal Head, Meter Cover	1730 g (61.02 oz)

Weight (stainless steel housing for biotechnology, pharmaceutical industries, and sanitary applications)

Option code	Standard cover	Meter cover
S1	840 g (27 oz)	995 g (32 oz)
S2	840 g (27 oz)	995 g (32 oz)
S3	840 g (27 oz)	995 g (32 oz)
S4	840 g (27 oz)	995 g (32 oz)

Enclosure ratings (644H)

All available enclosures are Type 4X, IP66, and IP68.

Sanitary housing surface

Surface finish is polished to 32 RMA. Laser etched product marking on housing and standard covers.

Performance specifications

EMC (electromagnetic compatibility) NAMUR NE 21 Standard

The 644H HART meets the requirements for NAMUR NE 21 Rating.

Susceptibility	Parameter	Influence
		HART
ESD	• 6 kV contact discharge • 8 kV air discharge	None
Radiated	• 80 – 1000 MHz at 10 V/m AM	< 1.0%
Burst	• 1 kV for I.O.	None
Surge	• 0.5 kV line–line • 1 kV line–ground (I.O. tool)	None
Conducted	• 10 kHz to 80 MHz at 10 V	< 1.0%

CE electromagnetic compatibility compliance testing

The 644 is compliant with Directive 2004/108/EC. Meets the criteria under IEC 61326:2006

Power supply effect

Less than ±0.005% of span per volt

Stability

RTDs and thermocouples have a stability of ±0.15% of output reading or 0.15 °C (whichever is greater) for 24 months.

Self calibration

The analog-to-digital measurement circuitry automatically self-calibrates for each temperature update by comparing the dynamic measurement to extremely stable and accurate internal reference elements.

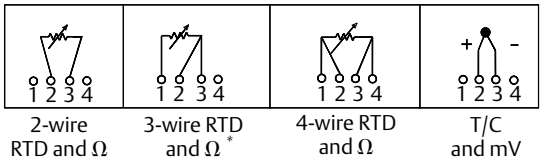
Vibration effect

The 644 is tested to the following specifications with no effect on performance per IEC 60770-1, 1999:

Frequency	Vibration
10 to 60 Hz	0.21 mm displacement
60 to 2000 Hz	3 g peak acceleration

Sensor connections

644 Sensor connections diagram



***Rosemount Inc. provides 4-wire sensors for all single element RTDs. You can use these RTDs in 3-wire configurations by leaving the unneeded leads disconnected and insulated with electrical tape.**

Tagging

Hardware

- 13 characters total
- Tags are adhesive labels affixed to the side of the transmitter.
- Permanently attached to transmitter
- Character height is 1/16-in (1.6 mm).

Software

- The transmitter can store up to 8 characters for the HART protocol.
- Order Software Tag with C1 option code.

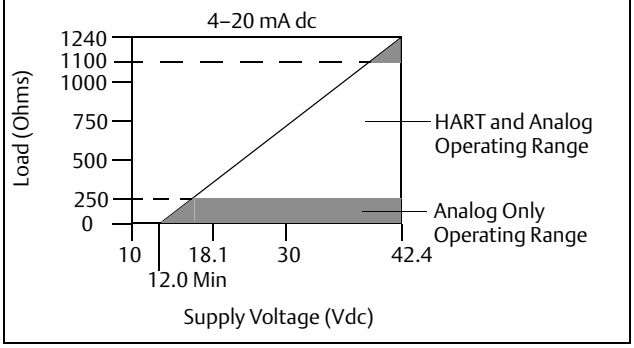
4–20 mA/HART specifications

Power supply

External power supply required. Transmitters operate on 12.0 to 42.4 Vdc transmitter terminal voltage (with 250 ohm load, 18.1 Vdc power supply voltage is required). Transmitter power terminals rated to 42.4 Vdc.

Load limitations

Maximum load = 40.8 X (supply voltage - 12.0)[1]



(1) Without transient protection (optional).

Note
HART Communication requires a loop resistance between 250 and 1100 ohms. Do not communicate with the transmitter when power is below 12 Vdc at the transmitter terminals.

Temperature limits

	Operating limit	Storage limit
With LCD display[1]	–40 to 185 °F –40 to 85 °C	–50 to 185 °F –45 to 85 °C
Without LCD display	–40 to 185 °F –40 to 85 °C	–60 to 248 °F –50 to 120 °C

(1) LCD display may not be readable and display updates will be slower at temperatures below -4 °F (-20 °C).

Hardware and software failure mode

The 644 features software driven alarm diagnostics and an independent circuit which is designed to provide backup alarm output if the microprocessor software fails. The alarm direction (HI/LO) is user-selectable using the failure mode switch. If failure occurs, the position of the switch determines the direction in which the output is driven (HI or LO). The switch feeds into the digital-to-analog (D/A) converter, which drives the proper alarm output even if the microprocessor fails. The values at which the transmitter software drives its output in failure mode depends on whether it is configured to standard, custom, or NAMUR-compliant (NAMUR recommendation NE 43, June 1997) operation. Table 7 shows the configuration alarm ranges.

Table 12. Available Alarm Range[1]

	Standard	NAMUR- NE 43 compliant
Linear Output:	3.9 ≤ I[2] ≤ 20.5	3.8 ≤ I ≤20.5
Fail High:	21.75 ≤ I ≤ 23	21.5 ≤ I ≤ 23
Fail Low:	3.5 ≤ I≤ 3.75	3.5 ≤ I≤ 3.6

(1) Measured in mA.
(2) I = Process Variable (current output).

Custom alarm and saturation level

Custom factory configuration of alarm and saturation level is available with option code C1 for valid values. These values can also be configured in the field using a Field Communicator.

Turn-on time

Performance within specifications in less than 5.0 seconds after power is applied, when damping value is set to 0 seconds.

Transient protection

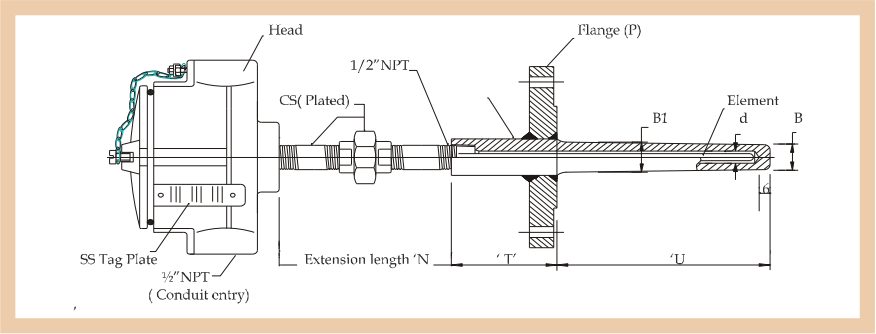
The Rosemount 470 Transient Protector prevents damage from transients induced by lightning, welding, or heavy electrical equipment. For more information, refer to the Rosemount 470 Transient Protector Product Data Sheet (document number 00813-0100-4191).

Accuracy

For complete accuracy tables by sensor type, see Table 8 on page 20. For ambient temperature effects by sensor type, see “Ambient temperature effect” on page 21. For Enhanced Accuracy specifications, see “Ambient temperature effect” on page 21.

Configuration

For standard and custom configuration information, see “Configuration” on page 37.



400 Series

Thermocouple & Resistance Thermometer Assemblies with

- A Flanged tapered Thermowell.
- Certified for use in hazardous area.
- Safe design as per ASME PTC19.3.
- Available with "in-head" 2-wire Temperature Transmitter.

Mi Thermocouple or Resistance Thermometer Sensor fitted into a terminal Head, and provided with head extension and drilled bar stock Flanged Thermowell would form a typical complete assembly ready for use in the application designed for. The design of the complete assembly depends on various parameters such as, temperature, dynamic pressure, flow velocity, abrasive nature of process fluid, intricate nature of installation and insertion lengths required.

High Velocity collar can be provided to reduce the suspended length of thermowell and to meet ASME PTC19.3 requirement. Thermowells are available in standard AISI 300 series Stainless Steel as well as exotic materials such as Incoloy 800, Inconel 600, Monel 400, Hastelloy alloys C276 and alloy B and flanges in ASTM grades A105, A182 and A350 and in sizes 3/4" to 2" (Dn20 to DN50).

The standard execution as shown in this leaflet is with plated CS extension and Aluminum head with conduit entry of ½"NPT and ungrounded Junction for Thermocouples unless specified otherwise.

Code	No of Elements
1	Simplex
2	Duplex
3	Triplex

Code	Elements
J	Iron-Constantan
K	Chromel-Alumel
T	Copper-Constanton
E	Chromel-Constanton
N	Nicrosil-Nisil
R	PtRh 13%-Pt
S	PtRh 10%-Pt
B	PtRh30%-PtRh6%
Pt	Pt100 RTD

Code	Sheath Dia	'd'
6	6mm	7.0mm
8	8mm	8.5mm
10	10mm	11.0mm

Code	Sheath Material
316	316SS
321	321SS
Inc	Inconel 600

Code	Head Type
D	Weatherproof
F	Flameproof IIA/IIB
C	Flameproof IIC
JB	Junction Box

Code	No of entries
1	One entry
2	Two entries

Code	Options
0	None
1	Head in 304SS
2	Head in 316SS
3	Extension in 304SS
4	Extension in 316SS
5	Other Conduit entry
6	In Head Transmitter
7	Brass Cable Gland
8	SS Cable Gland
10	Special requirement

Process Conn P	B	B
3/4"ANSI or DN20	17	12.5
1"ANSI or DN 25	22	16
1.5"ANSI or DN 40	25	19
2"ANSI or DN 50	28	25
Other sizes and dimensions on request		

Code	Well Extension
T	Define

Code	Well Insertion
U	Define

Code	Flange Material
A105	ASTM A105 (CS)
F316	A182 F316
F304	A182 F304
F321	A182 F321
F5	A182 F5
LF2	A350 LF2
Other materials also available. Define grade	

Code	Well Material
316	316SS
304	304SS
321	321SS
446	446SS

ORDERING EXAMPLE

400# SERIES 1-K-6-316-D-1-316-F316-U=150-T=70-1"150#RF-Op0

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

REV	DATE	ALTERED: / CHECKED:	REV	DATE	ALTERED / CHECKED

APPROVED WITH COMMENTS

STATUS : CONTRACT

JOB NO.: 412

Comments:-

1.GA of Complete Industrial grade furniture required for placing OWS, swivel chairs, printers, keyboards, computers etc. shall also be furnished by bidder. The exact details shall be finalized & approved by owner/purchaser during detailed engineering.
2.Laptop shall be provided.
3.GA of Control panel cum desk with HW annunciation windows, ILPBs, Ammeters, Annunciation & desk PBs, mimic, lamps, Indicators, recorders, etc.
4.Graphics shall be included.
5.Specification of all the applicable items (such as OWS,OEWS,Printers etc.shall be provided
6. All the applicable items shall be of reputed make and as per sub vendor list.
7.Complete BOM shall be included in this document clearly indicating model no.,make etc.
8.complete termination details shall be included for all the signals for each DI/DO/AI/AO/ RTD/TT etc.
9.GA and datasheet of UPS,battery etc.shall be provided.

2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

BHARAT HEAVY ELECTRICALS LIMITED
PROJECTS ENGINEERING MANAGEMENT, NOIDA.

BHEL DOC. NO. : PE - V11 - 412 - 174 - A125

SUB CONTRACTOR :DE NORA INDIA LIMITED
KUNDAIM - GOA

DE NORA

ASSOCIATE PARTNER : DE NORA WATER TECHNOLOGIES, SINGAPORE BRANCH

LOA NO: PW/PE/PG/EN1/P–24/17 DATED: 22 APR 2017

DEPT.	CODE		SCALE	WEIGHT(KG)	REF DRG.	ITEM
--	A		–	–	–	–

DETAIL OF PLC PANEL , BOM

	NAME	SIGN	DATE
PREP	SN		
CHKD	PG		
APPD	RF		

2018.02.1

DEPT.		CARD CODE	BHEL DOC. NO.	REV
SIGN	BHARAT HEAVY ELECTRICALS LTD PROJECT ENGINEERING MANAGEMENT. This approval/status shall be interpreted as laid down in the contract and it shall not relieve the contractor from the contractual obligation. APPROVAL CATEGORY AWARDED = II CAT I - Approved CAT II - Approved With Comments as Noted CAT III - Not Approved CAT IV - Reference Drawing DEPARTMENT: MECHANICAL AUXILIARY NAME: FALGUNI SAHA		–	PE - V11 - 412 - 174 - A125	A
DATE	6 09:26:53 +05'30'		NO. OF SHEETS 4 EXCLUDING COVER PAGE	

1.23 *Detail I/O List*

Local IO & Module Count Summary - Electro Chlorination Control Room					
Sr. No.	IO Count	DI	DO (With Relay)	AI (4-20 mA)	AO (4-20 mA)
1	Basic I/O Counts	104	62	58	4
	Channels per module	16	32	16	8
2	Total Module counts (with 20% Spares in each Module)	9	3	5	1
	Module Cat. No.	1756-IB16D	1756-OB32	1756-IF16	1756-OF8
4	Total Installed IO Counts 328 nos.	144	96	80	8

Note: 20% Spare Space kept in each Rack for future addition of modules

1.24 *Bill Of Material /Equipment*

Qty.	Catalog Number	Description
Hardware/software at centralized location		
	Software's for Engineering cum Operator Work Station	
1	9324-RLD300ENM	RSLogix 5000 Standard Edition, English
1	9324-RLDFBDENM	RSLogix 5000 Function Block Editor
1	9701-VWSTENM	FT View Studio for RS View Enterprise
1	9701-VWSB100AENM	FT View SE Station 100 Display
1	9301-OPCSRVENE	KEP OPC Server Enterprise
	Software's for Operator Work Station	
1	9701-VWSB100AENM	FT View SE Station 100 Display
	Third Party Software's for any one of the Engineering & Operator Station	
2	MS Office Basic	MS Office License Basic Excel, for all PC's
2	Antivirus	Antivirus for 1 users
	Bought outs Items at CPU Control Room	
1	LIU FO connectivity	8 Port LIU port with FO terminations for DCS connectivity PLC & DCS End
2	FO terminal	FO 10/100 mbps port to be inserted inside Switch
2	Ethernet Switch	Industrial Managed Switch with 8 Ethernet and 2 Fiber Port CISCO/D-Link/Phoenix
2	PC for work station	At Central ECS Control Room. With view Station License Commercial grade Latest Configuration 32 bit,60 GB HDD, Ram 512 MB preloaded with Windows 7 software with CD/DVD Drive, key board, mouse, MS Office Basic and Antivirus preinstalled Make: Del,HP (Pavilion),
2	PC for work station	24" LED/LCD monitor Make: Samsung/Dell/HP/Sharp
2	Console ES / OS	CRCA console welded construction to mount PC cum Monitor, Make: Pyrotech / RA Reputed.
1	IRIG-B	IRIG-B Card for receiving Irig-B Signal Inserted in 1 PC's
2	Chair	Chair for PC Godrej Make
310	Ethernet Cable	Ethernet Cat 6 Cable
1	Laserjet Printer	Black & White Laserjet Printer with network Color (A4 Size) HP/Cannon
1	Dot Matrix Printer	132 Column A3 Size Dot Matrix Printer with network HP/Cannon
2	Printer Console	CRCA console welded construction to mount Prinyter, Make: Pyrotech / RA Reputed

Qty.	Catalog Number	Description
PLC System BOM ECS Plant		
	Redundant Processor Electro Chlorination system	
2	1756-A7	7 Slot ControlLogix Chassis
2	1756-PA72	85-265 VAC Power Supply Assembly
2	1756-EN2TR	EtherNet dual port 10-100M Interface Module (supports 128 TCP/IP connections)
2	1756-EN2T	EtherNet 10-100M Interface Module (supports 128 TCP/IP connections)
2	1756-L73	ControlLogix5573 Controller With 8 Mbytes Memory
2	1756-RM2	Control logix redundant module
2	1756-RMC1	Redundancy module cable
6	1756-N2	Empty Slot Filler
	Local I/O Subsystem Electro Chlorination Control Room	
2	1756-A17	17 Slot ControlLogix Chassis
2	1756-PAR2	85-265 VAC Redundant Power Supply Assembly
2	1756-EN2TR	EtherNet dual port 10-100M Interface Module (supports 128 TCP/IP connections)
9	1756-IB16D	10-30 VDC Diagnostic Input 16 Pts (36 Pin)
3	1756-OB32	10-31 VDC Digital Output 32 Pts (36 Pin)
5	1756-IF16	Analog Input - Current/Voltage 16 Points (36 Pin)
1	1756-OF8	Analog Output - Current/Voltage 8 Pts (20 Pin)
17	1756-TBCH	Removable Terminal block 36 pin
1	1756-TBNH	Removable Terminal block 20 pin
14	1756-N2	Empty Slot Filler
2	1606-XL480E	Power Supply, 240 W, 24V DC, 20A 01 Set for Digital I/O's and Relays, 1 Set for Analog IO's
2	1606-XL480E	Power Supply, 240 W, 24V DC, 20A for SOV's
2	1606-XLSRED	Diode Module, for PSU Vin 1 -.9Vin, 480 W, 10-60V DC Input Voltage
	Bought outs Items	
12	Relay for DO	8 channel Relay Borads with Relays 2 SPDT 24 V DC Coil and contact Rating 5A for Selected SOV DO's
2	Processor cum IO Panel	Fully wired Processor Cum Local I/O Panel 1200w x 800d x 2115h Front & Rear Access with all accessories like Door Lock, Lifting hooks, Louvers & Filters, Gland plates and mounting plates etc. All equipment's mounted front side and Back side will be marshaling

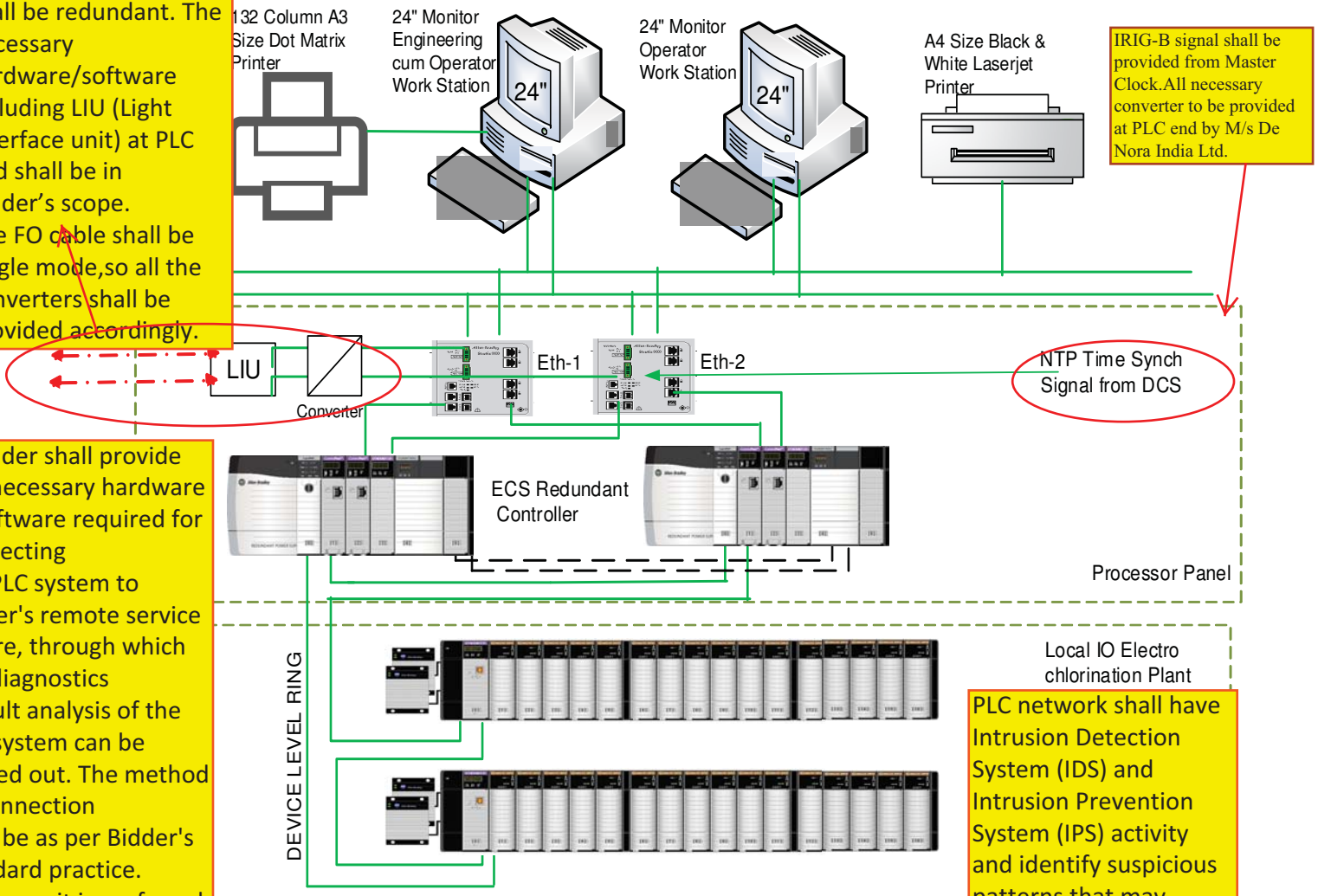
1.2.1 ***Services***

SERVICES for ECS Plant		
1 Lot	Engineering Services	Design, Engineering, Application Development, Documentation & Testing of total PLC System
1 Lot	Training	2 Engineers personnel training for a week at RA works. We shall providetraining voucher with system supply which shall be valid for 6 months. Training shall be availed within that time. If more validity required thenPlease let's inform same in advance.
1 Lot	Commissioning 25 Man Days in 1 visits	25 days manday support for Erection & Commissioning of PLC System of CPU-Plant considered. Network Set-Up (Ethernet & Modbus) at site. To from Air tickets, Coveyance, Boarding & Lodging is in customers scope

The communication between PLC and Main plant DCS shall be OPC compliant (Data Access 2.0) TCP/IP on Fibre Optic link. The communication link between PLC and Main plant DCS shall be redundant. The necessary hardware/software including LIU (Light Interface unit) at PLC end shall be in Bidder's scope. The FO cable shall be single mode,so all the converters shall be provided accordingly.

Please note that athe offered PLC model shall fulfill all the requirements as per specification.

System Architecture



1.Bidder shall provide the necessary hardware & software required for connecting the PLC system to Bidder's remote service centre, through which the diagnostics & fault analysis of the PLC system can be carried out. The method of connection shall be as per Bidder's standard practice. However, it is preferred to have the connection through a single point in the PLC system.

2.Bidder to note that all type of hardwares & electronic modules like controllers, I/O cards, communication modules and interface modules etc. used in PLC shall be of same family and sourced/supplied from their Principal's works.

ion will provide the following:
ary and final front layout design of control panel.
wiring diagram of control panel.
f internal equipement of control panel.
l details and plan.
ion details of control panel.
aterial of control panel.
t
e functional specification development and documentation.

PLC network shall have Intrusion Detection System (IDS) and Intrusion Prevention System (IPS) activity and identify suspicious patterns that may indicate a network or system attack from someone attempting to break into or compromise a system on the Station LAN Network, the recommended IDS/IPS should contain the following combined features. Any feature can be selected depending on whether it is to be configured as IPS or IDS.

1756 ControlLogix Controllers

The ControlLogix® controller provides a scalable controller solution that is capable of addressing a large amount of I/O points. The ControlLogix controller can be placed into any slot of a ControlLogix I/O chassis and multiple controllers can be installed in the same chassis.

ControlLogix controllers can monitor and control I/O across the ControlLogix backplane, as well as over network links. To provide communication for a ControlLogix controller, install the appropriate communication interface module into the chassis.

1756-L7*x* ControlLogix Controllers Features and Specifications

Feature	1756-L71, 1756-L72, 1756-L73, L73XT, 1756-L74, 1756-L75
Controller tasks	• 32 tasks • 100 programs/task • Event tasks: all event triggers
Built-in communication ports	1 port USB(1)
Communication options	• EtherNet/IP™ • ControlNet™ • DeviceNet™ • Data Highway Plus™ • Remote I/O • SynchLink™ • Third-party process and device networks
USB port communication	Programming, configuration, firmware flash and on-line edits only
Controller connections supported, max	500
Network connections, per network module	• 100 ControlNet (1756-CN2/A) • 40 ControlNet (1756-CNB/D, 1756-CNB/E) • 128 ControlNet (1756-CN2/B) • 256 EtherNet/IP; 128 TCP (1756-EN2*x*) • 128 EtherNet/IP; 64 TCP (1756-ENBT)
Controller redundancy	Full support
Integrated motion	• SERCOS interface • Analog options (encoder input, LDT input, SSI input) • EtherNet/IP (CIP Motion)
Programming languages	• Relay ladder • Structured text • Function block • SFC

(1) The USB port is intended for temporary local programming purposes only and not intended for permanent connection. Do not use the USB port in hazardous locations.

Table 1 - Technical Specifications - 1756-L7*x* ControlLogix Controllers

Attribute	1756-L71	1756-L72	1756-L73	1756-L74	1756-L75
User memory	2 MB	4 MB	8 MB	16 MB	32 MB
I/O memory	0.98 MB				
Optional nonvolatile memory storage	1 GB (1784-SD1 ships with every controller) 2 GB (1784-SD2)				
Digital I/O, max	128,000				
Analog I/O, max	4000				
Total I/O, max	128,000				
Energy storage module	• 1756-ESMCAP capacitor energy storage module (removable, ships installed with every controller) • 1756-ESMNSE capacitor energy storage module (removable, no residual WallClockTime power backup) • 1756-ESMNRM capacitor energy storage module (nonremovable, secures controller by preventing USB connection an d SD card use)				
Current draw @ 1.2V DC	5 mA				
Current draw @ 5.1V DC	800 mA				
Power dissipation	2.5 W				
Thermal dissipation	8.5 BTU/hr				
Isolation voltage	30V (continuous), basic insulation type, USB port-to-system Type tested at 500V AC for 60 s				
USB port(1)	USB 2.0, full speed (12 Mbps)				
Weight, approx	0.25 kg (0.55 lb)				
Slot width	1				
Module location	Chassis-based, any slot				
Chassis	1756-A4, 1756-A7, 1756-A10, 1756-A13, 1756-A17				
Power supply, standard	1756-PA72, 1756-PA75, 1756-PB72, 1756-PB75				
Power supply, redundant	1756-PA75R, 1756-PB75R, 1756-PSCA2				
Wire category(2)	3 - on USB port				
North American temperature code	T4A				
IEC temperature code	T4				
Enclosure type rating	None (open-style)				

(1) The USB port is intended for temporary local programming purposes only and not intended for permanent connection. Do not use the USB port in hazardous locations.

(2) Use this conductor category information for planning conductor routing. Refer to Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

Table 2 - Environmental Specifications - 1756-L7*x* ControlLogix Controllers

Attribute	1756-L71, 1756-L72, 1756-L73, 1756-L74, 1756-L75
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	0…60 °C (32…140 °F)
Temperature, nonoperating IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-40…85 °C (-40…185 °F)
Temperature, surrounding air, max	60 °C (140 °F)
Relative humidity IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	5…95% noncondensing
Vibration IEC 60068-2-6 (Test Fc, Operating)	2 g @ 10…500 Hz
Shock, operating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	50 g (45 g with SD card installed)
Emissions CISPR 11 IEC 61000-6-4	Class A
ESD immunity IEC 61000-4-2	6 kV contact discharges 8 kV air discharges
Radiated RF immunity IEC 61000-4-3	10V/m with 1 kHz sine-wave 80% AM from 80…2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 900 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 1890 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000…2700 MHz

Table 3 - Certifications - 1756-L7*x* ControlLogix Controllers

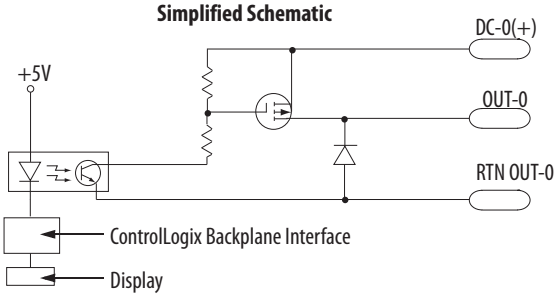
Certification(1)	1756-L71, 1756-L72, 1756-L73, 1756-L74, 1756-L75
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E65584. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810.
CE	European Union 2004/108/EC EMC Directive, compliant with: • EN 61326-1; Meas./Control/Lab., Industrial Requirements • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions • EN 61131-2; Programmable Controllers (Clause 8, Zone A & B)
C-Tick	Australian Radio communications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions
Ex	European Union 94/9/EC ATEX Directive, compliant with: • EN 60079-15; Potentially Explosive Atmospheres, Protection 'n' • EN 60079-0; General Requirements • II 3 G Ex nA IIC T4 X
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: Article 58-2 of Radio Waves Act, Clause 3

(1) When marked. See the Product Certification link at http://www.ab.com for Declarations of Conformity, Certificates, and other certification details.

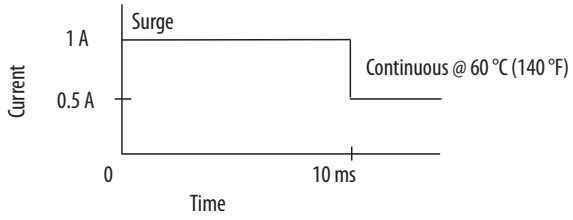
1756-0B32

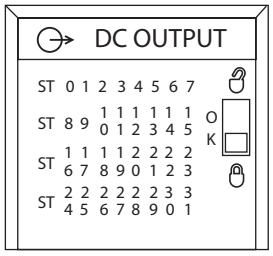
ControlLogix DC (10...31.2V) output module

Simplified Schematic



Surge Current Chart





1756-0B32

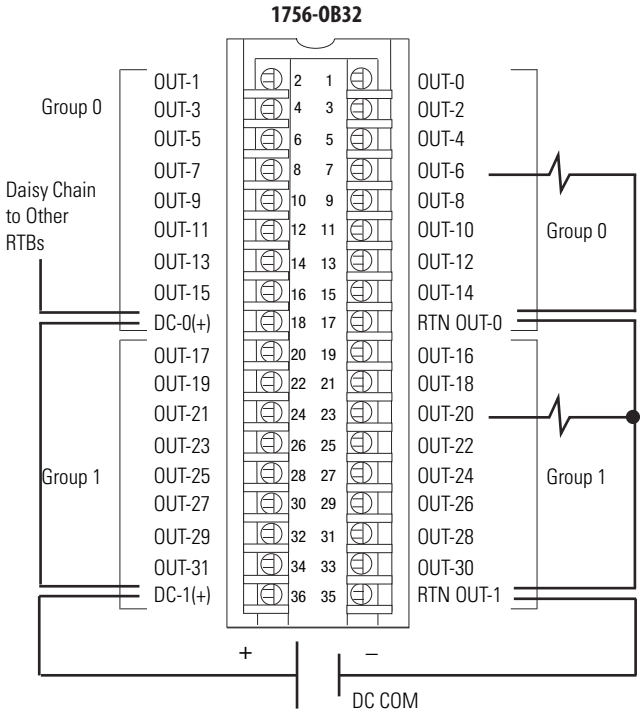


Table 158 - Technical Specifications - 1756-0B32

Attribute	1756-0B32
Outputs	32 (16 points/group)
Voltage category	12/24V DC source
Operating voltage range	10…31.2V DC
Output delay time Off to On On to Off	 60 µs nom/1 ms max 200 µs nom/1 ms max
Current draw @ 5.1V	300 mA
Current draw @ 24V	2 mA
Total backplane power	1.58 W
Power dissipation, max	4.8 W @ 60 °C (140 °F)
Thermal dissipation	16.37 BTU/hr
Off-state leakage current per point, max	0.5 mA per point
On-state voltage drop, max	200 mV DC @ 0.5 A

Table 158 - Technical Specifications - 1756-OB32 (Continued)

Attribute	1756-OB32
Current per point, max	0.5 A @ 50 °C (122 °F) linear derating 0.35 A @ 60 °C (140 °F)
Current per module, max	16 A @ 50 °C (122 °F) linear derating 10 A @ 60 °C (140 °F)
Surge current per point, max	1 A for 10 ms per point, repeatable every 2 s @ 60 °C (140 °F)
Load current, min	3 mA per point
Scheduled outputs	Synchronization within 16.7 s max, reference to the Coordinated System Time
States in Fault mode per point	Hold last state, On or Off (Off is default)
States in Program mode per point	Hold last state, On or Off (Off is default)
Isolation voltage	250V (continuous), basic insulation type, outputs-to-backplane, and output group-to-group No isolation between individual group outputs Routine tested @ 1350V AC for 2 s
Module keying	Electronic, software configurable
Fusing	Not protected. A fused IFM can be used to protect outputs. See publication 1492-TD008. However, the ControlLogix system has been agency certified using only the ControlLogix RTBs, that is, 1756-TBCH, 1756-TBNH, 1756-TBSH, and 1756-TBS6H. Any application that requires agency certification of the ControlLogix system using other wiring termination methods may require application-specific approval by the certifying agency.
Removable terminal block	1756-TBCH 1756-TBS6H
RTB keying	User-defined mechanical
Slot width	1
Wire category	1(1)
North American temperature code	T3C
IEC temperature code	T3
Enclosure type	None (open-style)

(1) Use this conductor category information for planning conductor routing as described in the system-level installation manual. See the Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

Table 159 - Environmental Specifications - 1756-OB32

Attribute	1756-OB32
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	0…60 °C (32…140 °F)
Temperature, surrounding air, max	60 °C (140 °F)
Temperature, nonoperating IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-40…85 °C (-40…185 °F)
Relative humidity IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	5…95% noncondensing
Vibration IEC 60068-2-6 (Test Fc, Operating)	2 g @ 10…500 Hz
Shock, operating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g

Table 159 - Environmental Specifications - 1756-OB32 (Continued)

Attribute	1756-OB32
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	50 g
Emissions	CISPR 11, Class A
ESD immunity IEC 61000-4-2	6 kV contact discharges 8 kV air discharges
Radiated RF immunity IEC 61000-4-3	10V/m with 1 kHz sine-wave 80% AM from 80…2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 900 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 1890 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000…2700 MHz
EFT/B immunity IEC 61000-4-4	±4 kV at 5 kHz on signal ports
Surge transient immunity IEC 61000-4-5	±1 kV line-line (DM) and ±2 kV line-earth (CM) on signal ports
Conducted RF immunity IEC 61000-4-6	10V rms with 1 kHz sine-wave 80% AM from 150 kHz…80 MHz

Table 160 - Certifications - 1756-OB32

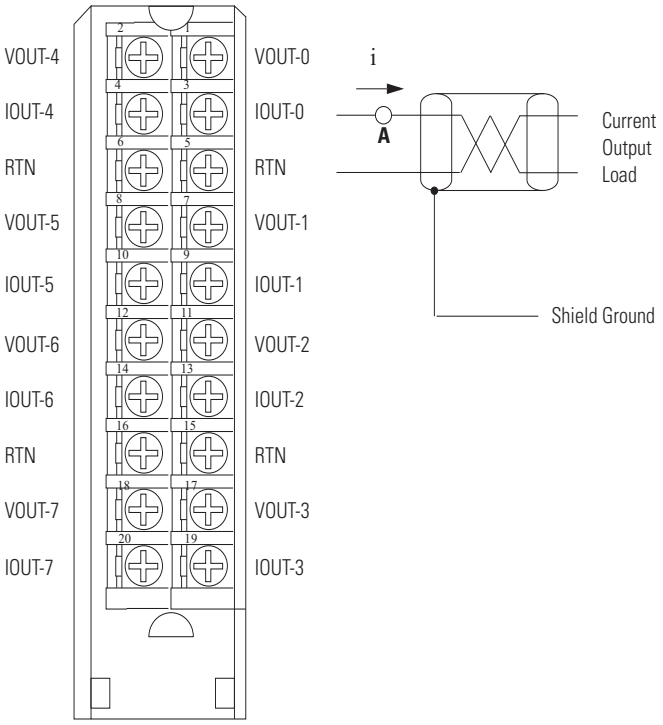
Certification(1)	1756-OB32
UL	UL Listed Industrial Control Equipment. See UL File E65584.
CSA	CSA Certified Process Control Equipment. See CSA File LR54689C. CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations. See CSA File LR69960C.
CE	European Union 2004/108/IEC EMC Directive, compliant with: • EN 61326-1; Meas./Control/Lab., Industrial Requirements • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions • EN 61131-2; Programmable Controllers (Clause 8, Zone A & B) European Union 2006/95/EC LVD, compliant with: EN 61131-2; Programmable Controllers (Clause 11)
C-Tick	Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions
Ex	European Union 94/9/EC ATEX Directive, compliant with: • EN 60079-15; Potentially Explosive Atmospheres, Protection "n" • EN 60079-0; General Requirements II 3 G Ex nA IIC T3 X Gc
FM	FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: Article 58-2 of Radio Waves Act, Clause 3

(1) When marked. See the Product Certification link at http://www.ab.com for Declarations of Conformity, Certificates, and other certification details.

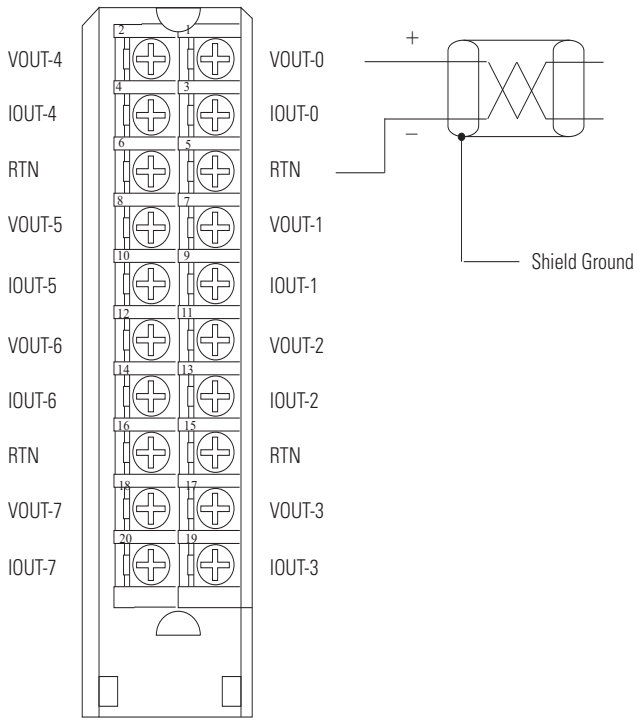
1756-0F8

ControlLogix voltage/current output analog module

1756-0F8 Current



1756-0F8 Voltage



- Place additional loop devices (such as strip chart recorders) at the A location noted above.
- All terminals marked RTN are connected internally.

All terminals marked RTN are connected internally.

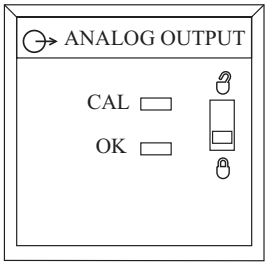


Table 176 - Signal and User Counts - 1756-0F8

Range	Low Signal and User Counts	High Signal and User Counts
0…20 mA	0 mA -32768 counts	21.2916 mA 32767 counts
±10V	-10.4336V -32768 counts	10.4336V 32767 counts

Table 177 - Technical Specifications - 1756-OF8

Attribute	1756-OF8
Outputs	8 voltage or current
Output range	± 10V 0…20 mA
Resolution	15 bits across 21 mA - 650 nA/bit 15 bits across 10.4V - 320 μV/bit
Current draw @ 5.1V	150 mA
Current draw @ 24V	210 mA
Total backplane power	5.8 W
Power dissipation, max	4.92 W, 8 channel current
Thermal dissipation	16.78 BTU/hr
Open circuit detection	Current output only (Output must be set to >0.1 mA)
Overvoltage protection	24V DC
Short circuit protection	Electronically current limited to 21 mA or less
Drive capability	Voltage: > 2000 Ω Current: 0…750 Ω
Settling time	< 2 ms to 95% of final value with resistive loads
Calibrated accuracy @ 25 °C (77 °F)	Better than 0.05% of range from 4…21 mA, -10.4…10.4V
Calibration interval	12 months typical
Offset drift	50 μV/°C typical (Voltage mode) 0.1 μA/°C typical (Current mode)
Gain drift with temperature, max	Voltage: 25 ppm/°C max Current: 50 ppm/°C max
Module error	Voltage: 0.15% of range Current: 0.3% of range
Module scan time, min	12 ms floating point 8 ms integer
Data format	Integer mode (left justified, 2s complement) IEEE 32-bit floating point
Module conversion method	R-Ladder DAC, monotonicity with no missing codes
Isolation voltage	250V (continuous), reinforced insulation type, output channels-to-backplane No isolation between individual output channels Routine tested at 1350V AC for 2 s
Module keying	Electronic, software configurable
Removable terminal block	1756-TBNH 1756-TBSH
RTB keying	User-defined mechanical
Slot width	1
Wire category	2(1)
North American temperature code	T4A
IEC temperature code	T4
Enclosure type	None (open-style)

(1) Use this conductor category information for planning conductor routing as described in the system-level installation manual. See the Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

Table 178 - Environmental Specifications - 1756-OF8

Attribute	1756-OF8
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	0…60 °C (32…140 °F)
Temperature, surrounding air, max	60 °C (140 °F)
Temperature, nonoperating IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-40…85 °C (-40…185 °F)
Relative humidity IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	5…95% noncondensing
Vibration IEC 60068-2-6 (Test Fc, Operating)	2 g @ 10…500 Hz
Shock, operating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	50 g
Emissions	CISPR 11, Class A
ESD immunity IEC 61000-4-2	6 kV contact discharges 8 kV air discharges
Radiated RF immunity IEC 61000-4-3	10V/m with 1 kHz sine-wave 80% AM from 80… 2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 900 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 1890 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000…2700 MHz
EFT/B immunity IEC 61000-4-4	±2 kV at 5 kHz on shielded signal ports
Surge transient immunity IEC 61000-4-5	±2 kV line-earth (CM) on shielded signal ports
Conducted RF immunity IEC 61000-4-6	10V rms with 1 kHz sine-wave 80% AM from 150 kHz…80 MHz on shielded signal ports

Table 179 - Certifications - 1756-0F8

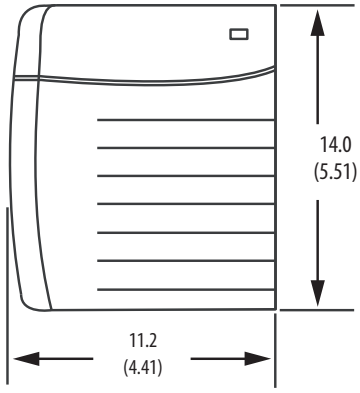
Certification[1]	1756-0F8
UL	UL Listed Industrial Control Equipment. See UL File E65584.
CSA	CSA Certified Process Control Equipment. See CSA File LR54689C. CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations. See CSA File LR69960C.
CE	European Union 2004/108/IEC EMC Directive, compliant with: • EN 61326-1; Meas./Control/Lab., Industrial Requirements • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions • EN 61131-2; Programmable Controllers (Clause 8, Zone A & B) European Union 2006/95/EC LVD, compliant with: EN 61131-2; Programmable Controllers (Clause 11)
C-Tick	Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions
Ex	European Union 94/9/EC ATEX Directive, compliant with: • EN 60079-15; Potentially Explosive Atmospheres, Protection "n" • EN 60079-0; General Requirements II 3 G Ex nA IIC T4 X Gc
FM	FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: Article 58-2 of Radio Waves Act, Clause 3

(1) When marked. See the Product Certification link at http://www.ab.com for Declarations of Conformity, Certificates, and other certification details.

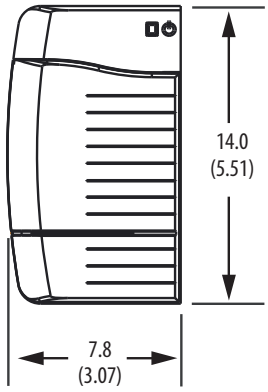
Standard AC Power Supplies

Mounting Dimensions

1756-PA72 and 1756-PA75



1756-PA50



Dimensions are in cm (in.).

Technical Specifications - Standard AC Power Supplies

Attribute	1756-PA50	1756-PA72/C	1756-PA75/B
Input voltage range[1]	85…265V AC		
Input voltage, nom	120V/240V AC		
Input frequency range	47…63 Hz		
Input power, max	81 W/91VA @ 50 °C (122 °F) 68 W/77VA @ 60 °C (140 °F)	100VA/100 W	
Output power, max	60 W @ 0…+50 °C (+32…+122 °F)[3] 50 W @ 0…+60 °C (+32…+140 °F)[4]	75 W @ 0…+60 °C (+32…+140 °F)[6]	
Inrush current, max	20 A		
Hold up time[2]	4 cycles @85...265V AC, 50/60 Hz, 60 W 5 cycles @85...265V AC, 50/60 Hz, 50 W	5 cycles @ 85V AC, 50/60 Hz 6 cycles @ 120V AC, 50/60 Hz 6 cycles @ 200V AC, 50/60 Hz 6 cycles @ 240V AC, 50/60 Hz	2 cycles @ 85V AC, 60 Hz 6 cycles @ 120V AC, 60 Hz 20 cycles @ 220V AC, 60 Hz
Current capacity @ 1.2V DC	1.5 A		
Current capacity @ 3.3V DC	2 A	4 A	
Current capacity @ 5.1V DC	8 A @ 50 °C (122 °F) 6 A @ 60 °C (140 °F)	10 A	13 A
Current capacity @ 24V DC	2.5 A @ 50 °C (122 °F) 2.0 A @ 60 °C (140 °F)	2.8 A	
Isolation voltage	250V (continuous), Reinforced Insulation Type, Power Input to Backplane Type tested @ 3150V DC for 60 s	250V (continuous), Reinforced Insulation Type, Power Input to Backplane Type tested at 3500V DC for 60 s	
Weight, approx	0.77 kg (1.7 lb)	0.95 kg (2.10 lb)	
Dimensions (HxWxD), approx	14.0 x 7.8 x 14.5 cm (5.51 x 3.07 x 5.71 in.)	14.0 x 11.2 x 14.5 cm (5.51 x 4.41 x 5.71 in.)	
Module location	Left side of 1756 chassis		
Chassis	1756-A4, 1756-A7, 1756-A10, 1756-A13, 1756-A17		
Chassis compatibility	Series A Series B Series C		Series B Series C
Wire size	2.5 mm^2 (14 AWG) solid or stranded copper wire rated at 90 °C (194 °F), or greater, 1.2 mm (3/64 in.) insulation max		

Technical Specifications - Standard AC Power Supplies

Attribute	1756-PA50	1756-PA72/C	1756-PA75/B
Wire category	1 - on power ports[5]		
Conductor screw torque	0.8 N•m (7 lb•in)		
North American temperature code	T4		
Enclosure type rating	None (open-style)		

(1) UL certification for 120/240V AC, 50/60 Hz nominal. Rockwell Automation specified 85…265V AC, 47…63 Hz.
(2) The hold up time is the time between input voltage removal and DC power failure.
(3) The combination of all output power (5.1V backplane, 24V backplane, 3.3V backplane, and 1.2V backplane) cannot exceed 60 W @ 50 °C (122 °F) maximum temperature.
(4) The combination of all output power (5.1V backplane, 24V backplane, 3.3V backplane, and 1.2V backplane) cannot exceed 50 W @ 60 °C (140 °F) maximum temperature.
(5) Use this conductor category information to plan conductor routing as described in the system level installation manual. See the Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.
(6) The combination of all output power (5.1V backplane, 24V backplane, 3.3V backplane, and 1.2V backplane) cannot exceed 75 W.

Environmental Specifications - Standard AC Power Supplies

Attribute	1756-PA50	1756-PA72/C, 1756-PA75/B
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	0 °C < Ta < +60 °C (+32 °F < Ta < +140 °F)	
Temperature, surrounding air, max	60 °C (140 °F)	
Temperature, non-operating IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-40…+85 °C (-40…+185 °F)	
Relative humidity IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	5…95% noncondensing	
Vibration IEC 60068-2-6 (Test Fc, Operating)	2 g @ 10…500 Hz	
Shock, operating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g	
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	50 g[1]	
Emissions	IEC 61000-6-4	
ESD immunity IEC 61000-4-2	6 kV contact discharges 8 kV air discharges	
Radiated RF immunity IEC 61000-4-3	10V/m with 1 kHz sine-wave 80% AM from 80…2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 900 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 1890 MHz 3V/m with 1kHz sine-wave 80% AM from 2000…2700 MHz	
EFT/B immunity IEC 61000-4-4	±4 kV at 5 kHz on power ports	
Surge transient immunity IEC 61000-4-5	±1 kV line-line (DM) and ±2 kV line-earth (CM) on power ports	
Conducted RF immunity IEC 61000-4-6	10V rms with 1 kHz sine-wave 80% AM from 150 kHz…80 MHz	
Voltage variation IEC 61000-4-11	30% dips for 1 period at 0° and 180° on AC supply ports 60% dips for 5 and 50 periods on AC supply ports ±10% fluctuations for 15 min on AC supply ports >95% interruptions for 250 periods on AC supply ports	
Damped oscillatory wave immunity IEC 61000-4-18	±2.5 kV line-line (DM) and ±2.5 kV line-earth (CM) on power ports	–

(1) Series C chassis have a maximum nonoperating shock value of 30 g. If you select a Series C chassis for use with your power supply, you are limited to a maximum nonoperating shock value of 30 g.

Certifications - Standard AC Power Supplies

Certification[1]	1756-PA50	1756-PA72/C	1756-PA75/B
UL	–	UL Listed Industrial Control Equipment. See UL File E65584.	
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E65584. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810.	–	
CSA	–	CSA Certified Process Control Equipment. See CSA File LR54689C. CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations. See CSA File LR69960C.	
FM	FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations		
CE	European Union 2014/30/EU EMC Directive, compliant with: • EN 61326-1; Meas./Control/Lab., Industrial Requirements • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions • EN 61131-2; Programmable Controllers (Clause 8, Zone A & B) European Union 2014/35/EU LVD, compliant with: • EN 61010-2-201; Control Equipment Safety Requirements	European Union 2014/30/EU EMC Directive, compliant with: • EN 61326-1; Meas./Control/Lab., Industrial Requirements • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions • EN 61131-2; Programmable Controllers (Clause 8, Zone A & B) European Union 2014/35/EU LVD, compliant with: • EN 61131-2; Programmable Controllers (Clause 11)	
RCM	Australian Radiocommunications Act, compliant with: • EN 61000-6-4; Industrial Emissions		
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: • Article 58-2 of Radio Waves Act, Clause 3		
EAC	Russian Customs Union TR CU 020/2011 EMC Technical Regulation Russian Customs Union TR CU 004/2011 LV Technical Regulation		

(1) See the Product Certification link at http://www.ab.com for Declarations of Conformity, Certificates, and other certification details.

Table 28 - Technical Specifications - 1756 Redundancy Modules

Attribute	1756-RM	1756-RM2	1756-RMXT	1756-RM2XT
Current draw @ 1.2V DC	4 mA	—	4 mA	—
Current draw @ 5.1V DC	1.2 A	1.16A	1.2 A	1.16A
Current draw @ 24V DC	120 mA	3.4 mA	120 mA	3.4 mA
Power dissipation	9.0 W	6 W, max	9.0 W	6 W, max
Thermal dissipation	31 BTU/hr	21 BTU/hr	31 BTU/hr	21 BTU/hr
Connector cables	1756-RMC1, 1 m (3.28 ft) 1756-RMC3, 3 m (9.84 ft) 1756-RMC10, 10 m (32.81 ft)			
Slot width	1 slot			
Module location	Chassis-based, any slot			
Chassis	1756-A4, 1756-A7, 1756-A10, 1756-A13, 1756-A17		1756-A7XT, 1756-A4LXT, 1756-A5LXT, 1756-A7LXT	
Power supply, standard	1756-PA72, 1756-PA75, 1756-PB72, 1756-PB75		1756-PAXT, 1756-PBXT	
Power supply, redundant	1756-PA75R, 1756-PB75R, 1756-PSCA2		None	
North American temperature code	T4			
IEC temperature code	T4			
Enclosure type	None (open-style)			
Weight, approx	0.29 kg (0.64 lb)			
Mounting	ControlLogix-XT chassis, single-slot module			

Table 29 - Environmental Specifications - 1756 Redundancy Module

Attribute	1756-RM	1756-RM2	1756-RMXT	1756-RM2XT
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	0…60 °C (32…140 °F)		-25…70 °C (-13…158 °F) When using a 1756-A7LXT chassis, surrounding air temperature range is -25…60 °C (-13…140 °F) even when using an 'XT' redundancy module.	-25…70 °C (-13…158 °F)
Temperature, storage IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-40…85 °C (-40…185 °F)			
Temperature, surrounding air, max	60 °C (140 °F)		70 °C (158 °F)	
Relative humidity IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	5…95% noncondensing			
Vibration IEC 60068-2-6 (Test Fc, Operating)	2 g @ 10…500 Hz			
Shock, operating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g			
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	50 g			

Table 29 - Environmental Specifications - 1756 Redundancy Module (Continued)

Attribute	1756-RM	1756-RM2	1756-RMXT	1756-RM2XT
Emissions CISPR 11 IEC 61000-6-4	Group 1, Class A	Class A	Group 1, Class A	Class A
ESD immunity IEC 61000-4-2	6 kV contact discharges 8 kV air discharges			
Radiated RF immunity IEC 61000-4-3	10V/m with 1 kHz sine-wave 80% AM from 80…2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 900 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 1890 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000…2700 MHz			

Table 30 - Certifications - 1756 Redundancy Module

Certification(1)	1756-RM	1756-RMXT	1756-RM2	1756-RM2XT
CSA	CSA Certified Process Control Equipment. See CSA File LR54689C. CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations. See CSA File LR69960C.	—	CSA Certified Process Control Equipment. See CSA File LR54689C. CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations. See CSA File LR69960C.	—
CE	European Union 2004/108/IEC EMC Directive, compliant with: • EN 61326-1; Meas./Control/Lab., Industrial Requirements • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions • EN 61131-2; Programmable Controllers (Clause 8, Zone A & B)			
C-Tick	Australian Radio communications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions			
c-UL-us	UL Listed Industrial Control Equipment, certified for U.S. and Canada. See UL file E65584. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810.			
Ex	European Union 94/9/EC ATEX Directive, compliant with: • EN 60079-15; Potentially Explosive Atmospheres, Protection “n” • EN 60079-0; General Requirements • II 3 G Ex nA IIC T4 X Gc			
FM	FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations	—	FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations	—
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: Article 58-2 of Radio Waves Act, Clause 3			

(1) When marked. See the Product Certification link at http://www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1756 Removable Terminal Blocks

Removable terminal blocks (RTBs) provide a flexible interconnection between your plant wiring and 1756 I/O modules. The RTB plugs into the front of the I/O module. The type of module determines which RTB you need. You can choose screw-clamp or spring-clamp RTBs.

RTBs are not shipped with I/O modules. You must order them separately. The standard housing on the front of the wiring arm is not deep enough for 2.5 mm^2 (14 AWG) wiring. If you plan to use 2.5 mm^2 (14 AWG) wiring, also order the extended housing.

ATTENTION: If separate power sources are used, do not exceed the specified isolation voltage: referring to each individual module's specifications on the preceding pages.

Table 235 - RTB Specifications - 1756-TBNH, 1756-TBSH, 1756-TBCH, 1756-TBS6H, 1756-TBE

Attribute	1756-TBNH	1756-TBSH	1756-TBCH	1756-TBS6H	1756-TBE
Description	20-position NEMA screw-clamp removable block	20-pin spring-clamp removable terminal block with standard housing	36-pin cage-clamp removable terminal block with standard housing	36-pin spring-clamp removable terminal block with standard housing	Extended depth terminal block housing
Screw torque	1.36 N•m (12 lb•in)	N/A	0.5 N•m (4.4 lb•in)	N/A	N/A
Wire size(1)	0.33…2.1 mm^2 (22…14 AWG) solid or stranded copper wire rated at 90 °C (194 °F), or greater, 1.2 mm (3/64 in.) insulation max Do not wire more than two conductors on any single terminal.	0.33…2.1 mm^2 (22…14 AWG) solid or stranded copper wire rated at 90 °C (194 °F), or greater, 1.2 mm (3/64 in.) insulation max Do not wire more than one conductors on any single terminal.	Single wire connection: 0.33…2.1 mm^2 (22…14 AWG) solid or stranded copper wire rated at 90 °C (194 °F), or greater, 1.2 mm (3/64 in.) insulation max Double wire connection: 0.33…1.3 mm^2 (22…16 AWG) solid or stranded copper wire rated at 90 °C (194 °F), or greater, 1.2 mm (3/64 in.) insulation max Do not wire more than two conductors on any single terminal.	0.33…2.1 mm^2 (22…14 AWG) solid or stranded copper wire rated at 90 °C (194 °F), or greater, 1.2 mm (3/64 in.) insulation max Do not wire more than one conductors on any single terminal.	
Screwdriver width	8 mm (5/16 in.) max	N/A	3.2 mm (1/8 in.)	N/A	N/A

(1) Maximum wire size requires extended housing, catalog number 1756-TBE.

Standard ControlLogix Chassis Specifications

The chassis backplane provides a high-speed communication path between modules and distributes power to each of the modules within the chassis.

Technical Specifications - ControlLogix Standard Chassis (Series B)

Attribute	1756-A4/B	1756-A7/B	1756-A10/B	1756-A13/B	1756-A17/B
Backplane current, chassis/slot max @ 1.2V DC	1.5 A/–				
Backplane current, chassis/slot max @ 3.3V DC	4 A/4 A				
Backplane current, chassis/slot max @ 5.1V DC	15 A/6 A				
Backplane current, chassis/slot max @ 24V DC	2.8 A/2.8 A				
Power dissipation, max	4 W	4.5 W	5 W	5.4 W	6 W
Isolation voltage	Determined by installed power supply and modules				
Slots	4	7	10	13	17
Mounting method	Only horizontal				
Cabinet size (HxWxD), min	50.8 x 50.8 x 20.3 cm (20 x 20 x 8 in.)	50.8 x 60.9 x 20.3 cm (20 x 24 x 8 in.)	50.8 x 76.2 x 20.3 cm (20 x 30 x 8 in.)	60.9 x 76.2 x 20.3 cm (24 x 30 x 8 in.)	76.2 x 91.4 x 20.3 cm (30 x 36 x 8 in.)
Weight, approx	0.75 kg (1.7 lb)	1.10 kg (2.4 lb)	1.45 kg (3.2 lb)	1.90 kg (4.2 lb)	2.20 kg (4.8 lb)
Location	Panel				
Wire size	Functional Earth Ground - 8.3 mm^2 (8 AWG) solid or stranded copper wire rated at 90 °C (194 °F) or greater Protective Earth Ground - 2.1 mm^2 (14 AWG) solid or stranded copper wire rated at 90 °C (194 °F) or greater				
North American temperature code	T5				
IEC temperature code	T4	T5			
Enclosure type rating	None (open-style)				

Technical Specifications - ControlLogix Standard Chassis (Series C)

Attribute	1756-A4/C	1756-A7/C	1756-A10/C	1756-A13/C	1756-A17/C
Backplane current, chassis/slot max @ 1.2V DC	1.5 A/–				
Backplane current, chassis/slot max @ 3.3V DC	4 A/4 A				
Backplane current, chassis/slot max @ 5.1V DC	15 A/6 A				
Backplane current, chassis/slot max @ 24V DC	2.8 A/2.8 A				
Power dissipation, max	4 W	4.5 W	5 W	5.4 W	6 W
Isolation voltage	Determined by installed power supply and modules				
Slots	4	7	10	13	17
Mounting method	Only horizontal				
Cabinet size (HxWxD), min	50.8 x 50.8 x 20.3 cm (20 x 20 x 8 in.)	50.8 x 60.9 x 20.3 cm (20 x 24 x 8 in.)	50.8 x 76.2 x 20.3 cm (20 x 30 x 8 in.)	60.9 x 76.2 x 20.3 cm (24 x 30 x 8 in.)	76.2 x 91.4 x 20.3 cm (30 x 36 x 8 in.)
Weight, approx	0.75 kg (1.7 lb)	1.10 kg (2.4 lb)	1.45 kg (3.2 lb)	1.90 kg (4.2 lb)	2.20 kg (4.8 lb)
Location	Panel				
Wire size	Functional earth ground - 8.3 mm^2 (8 AWG) solid or stranded copper wire rated at 90 °C (194 °F) or greater Protective earth ground - 2.1 mm^2 (14 AWG) solid or stranded copper wire rated at 90 °C (194 °F) or greater				
North American temperature code	T4				
IEC temperature code	T4				
Enclosure type rating	None (open-style)				

Environmental Specifications - ControlLogix Standard Chassis

Attribute	1756-A4/B, 1756-A7/B, 1756-A10/B, 1756-A13/B, 1756-A17/B	1756-A4/C, 1756-A7/C, 1756-A10/C, 1756-A13/C, 1756-A17/C
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	0…60 °C (32…140 °F)	-25…+60 °C (-13…+140 °F)
Temperature, surrounding air	60 °C (140 °F)	
Temperature, nonoperating IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-40…+85 °C (-40…+185 °F)	
Relative humidity IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	5…95% noncondensing	
Vibration IEC 60068-2-6 (Test Fc, Operating)	2 g @ 10…500 Hz	
Shock, operating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g	
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	50 g	30 g
Emissions	IEC 61000-6-4	
ESD immunity IEC 61000-4-2	6 kV contact discharges 8 kV air discharges	
Radiated RF immunity IEC 61000-4-3	10V/m with 1 kHz sine-wave 80% AM from 80…2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 900 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 1890 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000…2700 MHz	

Certifications - ControlLogix Standard Chassis

Certification[1]	1756-A4/B	1756-A7/B, 1756-A10/B, 1756-A13/B, 1756-A17/B	1756-A4/C, 1756-A7/C, 1756-A10/C, 1756-A13/C, 1756-A17/C
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E65584. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810.		
CSA	CSA Certified Process Control Equipment. See CSA File 54689. CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations. See CSA File 69960.		
FM	FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations.		
CE	European Union 2004/108/EC EMC Directive, compliant with: • EN 61326-1; Meas./Control/Lab., Industrial Requirements • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions • EN 61131-2; Programmable Controllers (Clause 8, Zone A & B)		
RCM	Australian Radiocommunications Act, compliant with: EN 61000-6-4; Industrial Emissions		
Ex	European Union 94/9/EC ATEX Directive, compliant with: • EN 60079-15; Potentially Explosive Atmospheres, Protection "n" • EN 60079-0; General Requirements • II 3 G Ex nA IIC T4 Gc X	European Union 94/9/EC ATEX Directive, compliant with: • EN 60079-15; Potentially Explosive Atmospheres, Protection "n" • EN 60079-0; General Requirements • II 3 G Ex nA IIC T5 Gc X	European Union 94/9/EC ATEX Directive, compliant with: • EN 60079-15; Potentially Explosive Atmospheres, Protection "n" • EN 60079-0; General Requirements • II 3 G Ex nA IIC T4 Gc • DEMK013ATEX1325026X
IECEx	N/A		IECEx System, compliant with: • IEC 60079-15; Potentially Explosive Atmospheres, Protection "n" • IEC 60079-0; General Requirements • II 3 G Ex nA IIC T4 Gc • IECExUL14.0008X
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: Article 58-2 of Radio Waves Act, Clause 3		
EAC	Russian Customs Union TR CU 020/2011 EMC Technical Regulation Russian Customs Union TR CU 004/2011 LV Technical Regulation		

(1) See the Product Certification link at http://www.ab.com for Declarations of Conformity, Certificates, and other certification details.

Communication Connections

A ControlLogix system uses connections to establish communication links between devices. The types of connections include the following:

- Controller-to-local I/O modules or local communication modules
- Controller-to-remote I/O or remote communication modules
- Controller-to-remote I/O (rack-optimized) modules
- Produced and consumed tags
- Messages
- Controller access with the Studio 5000 environment
- Controller access with RSLinx® software for HMI or other applications

You indirectly determine the number of connections the controller uses by configuring the controller to communicate with other devices in the system. The limit of connections ultimately resides in the communication module you use for the connection. If a message path routes through a communication module, the connection that is related to the message also counts towards the connection limit of that communication module.

EtherNet/IP Network

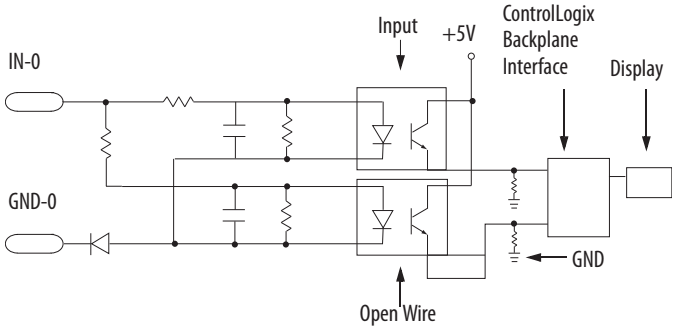
The Ethernet Industrial (EtherNet/IP) network protocol is an open industrial-networking standard that supports both real-time I/O messaging and message exchange. The EtherNet/IP network uses off-the-shelf Ethernet communication chips and physical media.

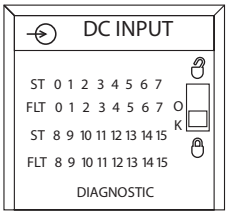
If you need to	Select this interface
Control I/O modules and drives Act as an adapter for I/O on remote EtherNet/IP links Communicate with other EtherNet/IP devices (messages and HMI) Bridge EtherNet/IP links to route messages to devices on other networks	1756-EN2F bridge 1756-EN2T bridge 1756-EN2TP bridge 1756-EN2TPXT bridge 1756-EN2TR bridge 1756-ENBT bridge
Support device level ring (DLR) and linear topologies	1756-EN2TR, 1756-EN2TRK redundant bridge 1756-EN3TR, 1756-EN2TRK redundant bridge
Support for Parallel Redundancy Protocol	1756-EN2TP bridge, 1756-EN2TPXT bridge, 1756-EN2TPK PRP bridge
Provide PRP control in environments where temperatures range from -25…70 °C (-13…158 °F)	1756-EN2TPXT bridge
Provide control in environments where temperatures range from -25…70 °C (-13…158 °F)	1756-EN2TXT bridge
Support device level ring (DLR) and linear topologies Provide control in environments where temperatures range from -25…70 °C (-13…158 °F)	1756-EN2TRXT redundant bridge
Secure access to a control system from within the plant network	1756-EN2TSC bridge
Use an Internet browser to remotely access tags in a ControlLogix controller Communicate with other EtherNet/IP or generic Ethernet devices (messaging only; no I/O control) Bridge EtherNet/IP links to route messages to devices on other networks	1756-EWEB, 1756-EWEBK web server 1756-EN2TRXT bridge 1756-EN2TPXT bridge

1756-IB16D

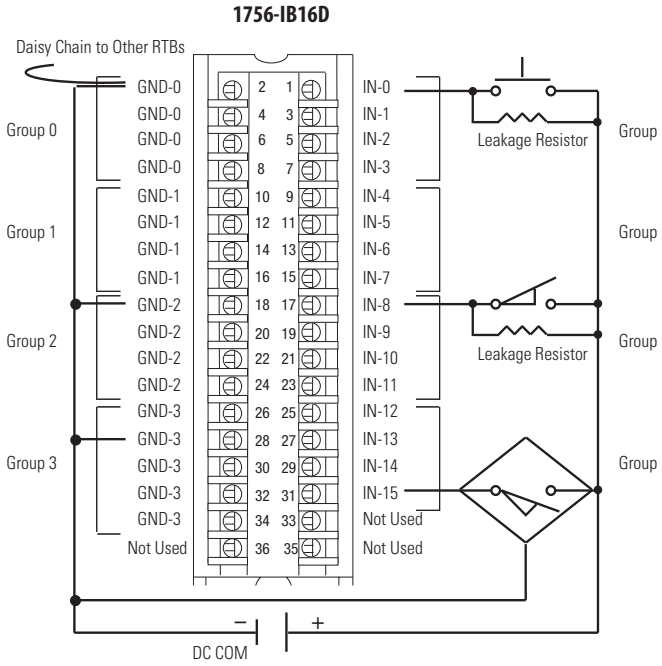
ControlLogix DC (10...30V) diagnostic input module

Simplified Schematic





1756-IB16D



Recommended Leakage Resistor Size 1/4 W, 5%	Supply Voltage
3.9K	10V DC
5.6K	12V DC
15K	24V DC
20K	30V DC

Table 17 - Diagnostic Specifications - 1756-IB16D

Attribute	1756-IB16D
Open wire	Off-state leakage current 1.2 mA min
Timestamp of diagnostics	±1 ms

Table 18 - Technical Specifications - 1756-IB16D

Attribute	1756-IB16D
Inputs	16 diagnostic (4 points/group)
Voltage category	12/24V DC sink
Operating voltage range	10…30V DC
Input voltage, nom	24V DC

Table 18 - Technical Specifications - 1756-IB16D (Continued)

Attribute	1756-IB16D
Input delay time (screw to backplane) Off to On On to Off	 Hardware delay: 340 µs nom/1 ms max + filter time User-selectable filter time: 0, 1, or 2 ms Hardware delay: 740 µs nom/4 ms max + filter time User-selectable filter time: 0, 1, 9, or 18 ms
Current draw @ 5.1V	150 mA
Current draw @ 24V	3 mA
Total backplane power	0.84 W
Power dissipation, max	5.8 W @ 60 °C (140 °F)
Thermal dissipation	19.78 BTU/hr
Off-state voltage, max	5V
Off-state current, max	1.5 mA
On-state current, min	2 mA @ 10V DC
On-state current, max	13 mA @ 30V DC
Inrush current, max	250 mA
Input impedance, max	2.31 kΩ @ 30V DC
Cyclic update time	200 µs…750 ms
Change of state	Software configurable
Timestamp of inputs	±200 µs
Isolation voltage	250V (continuous), basic insulation type, inputs-to-backplane, and input group-to-group No isolation between individual group inputs Routine tested @ 1350V AC for 2 s
Module keying	Electronic, software configurable
Removable terminal block housing	1756-TBCH 1756-TBS6H
RTB keying	User-defined mechanical
Slot width	1
Wire category	1(1)
North American temperature code	T3C
IEC temperature code	T3
Enclosure type	None (open-style)
Reverse polarity protection	Yes

(1) Use this conductor category information for planning conductor routing as described in the system-level installation manual. See the Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

Table 19 - Environmental Specifications - 1756-IB16D

Attribute	1756-IB16D
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	0…60 °C (32…140 °F)
Temperature, surrounding air, max	60 °C (140 °F)
Temperature, nonoperating IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-40…85 °C (-40…185 °F)
Relative humidity IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	5…95% noncondensing
Vibration IEC 60068-2-6 (Test Fc, Operating)	2 g @ 10…500 Hz
Shock, operating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	50 g
Emissions	CISPR 11, Class A
ESD immunity IEC 61000-4-2	6 kV contact discharges 8 kV air discharges
Radiated RF immunity IEC 61000-4-3	10V/m with 1 kHz sine-wave 80% AM from 80… 2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 900 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 1890 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000…2700 MHz
EFT/B immunity IEC 61000-4-4	±4 kV at 5 kHz on signal ports
Surge transient immunity IEC 61000-4-5	±1 kV line-line (DM) and ±2 kV line-earth (CM) on signal ports
Conducted RF immunity IEC 61000-4-6	10V rms with 1 kHz sine-wave 80% AM from 150 kHz…80 MHz

Table 20 - Certifications - 1756-IB16D

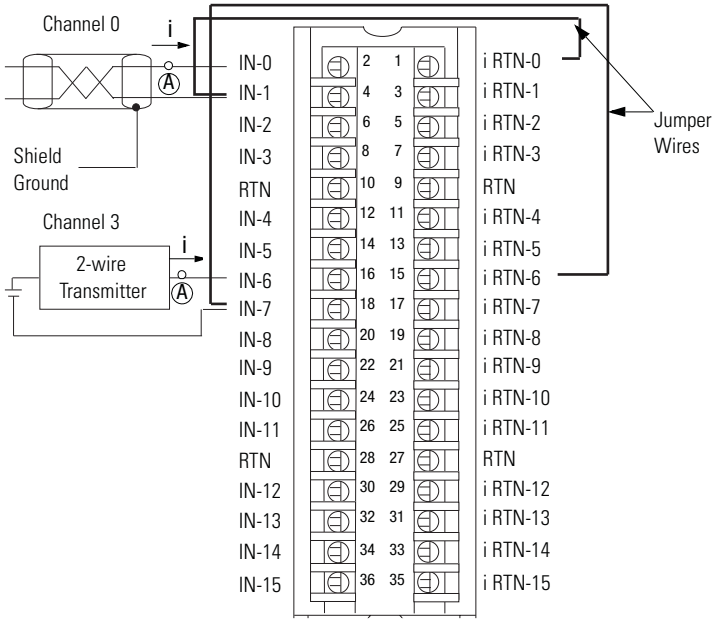
Certifications[1]	1756-IB16D
UL	UL Listed Industrial Control Equipment. See UL File E65584.
CSA	CSA Certified Process Control Equipment. See CSA File LR54689C. CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations. See CSA File LR69960C.
CE	European Union 2004/108/IEC EMC Directive, compliant with: • EN 61326-1; Meas./Control/Lab., Industrial Requirements • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions • EN 61131-2; Programmable Controllers (Clause 8, Zone A & B) European Union 2006/95/EC LVD, compliant with: EN 61131-2; Programmable Controllers (Clause 11)
C-Tick	Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: Article 58-2 of Radio Waves Act, Clause 3
Ex	European Union 94/9/EC ATEX Directive, compliant with: • EN 60079-15; Potentially Explosive Atmospheres, Protection "n" • EN 60079-0; General Requirements II 3 G Ex nA IIC T3 X Gc
FM	FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations

(1) When marked. See the Product Certification link at http://www.ab.com for Declarations of Conformity, Certificates, and other certification details.

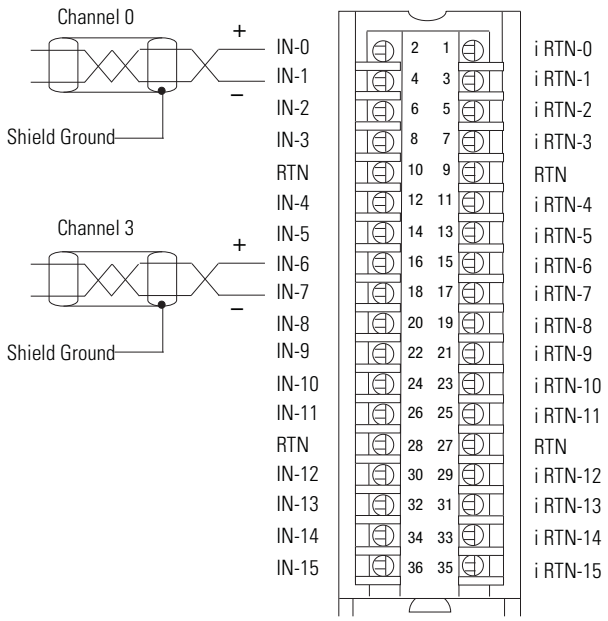
1756-IF16

ControlLogix voltage/current analog input module

1756-IF16 Differential Current



1756-IF16 Differential Voltage



Use this table when wiring your module in Differential mode.

This channel	Uses these terminals
Channel 0	IN-0 (+), IN-1 (-), i RTN-0
Channel 1	IN-2 (+), IN-3 (-), i RTN-2
Channel 2	IN-4 (+), IN-5 (-), i RTN-4
Channel 3	IN-6 (+), IN-7 (-), i RTN-6
Channel 4	IN-8 (+), IN-9 (-), i RTN-8
Channel 5	IN-10 (+), IN-11 (-), i RTN-10
Channel 6	IN-12 (+), IN-13 (-), i RTN-12
Channel 7	IN-14 (+), IN-15 (-), i RTN-14

- All terminals marked RTN are connected internally.
- A 249 Ω current loop resistor is located between IN-*x* and i RTN-*x* terminals.
- If multiple (+) or multiple (-) terminals are tied together, connect that tie point to a RTN terminal to maintain the module's accuracy.
- Place additional loop devices (such as strip chart recorders) at the A location in the current loop.

IMPORTANT: When operating in 4 channel, High Speed mode, only use channels 0, 2, 4, and 6.

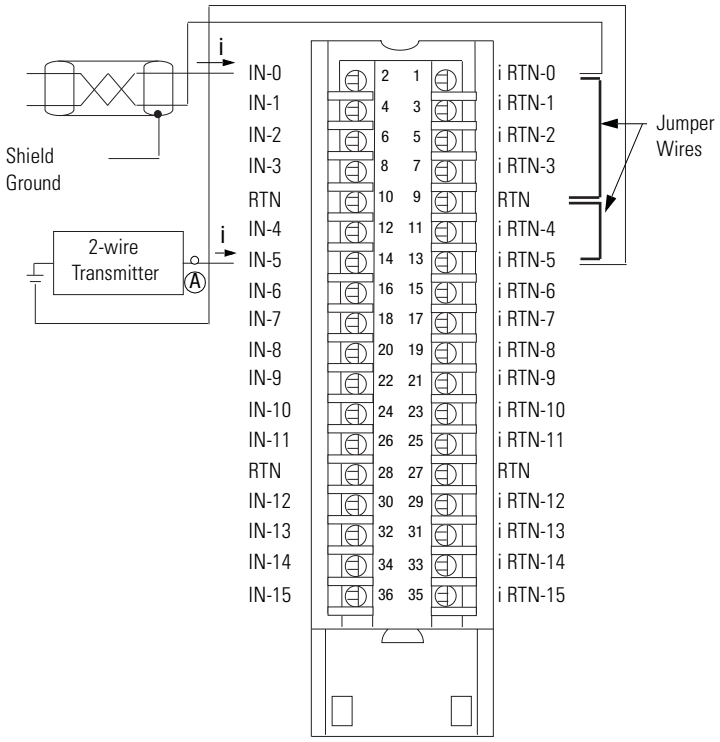
Use this table when wiring your module in Differential mode.

This channel	Uses these terminals
Channel 0	IN-0 (+), IN-1 (-)
Channel 1	IN-2 (+), IN-3 (-)
Channel 2	IN-4 (+), IN-5 (-)
Channel 3	IN-6 (+), IN-7 (-)
Channel 4	IN-8 (+), IN-9 (-)
Channel 5	IN-10 (+), IN-11 (-)
Channel 6	IN-12 (+), IN-13 (-)
Channel 7	IN-14 (+), IN-15 (-)

- All terminals marked RTN are connected internally.
- If multiple (+) or multiple (-) terminals are tied together, connect that tie point to a RTN terminal to maintain the module's accuracy.
- Terminals marked RTN or i RTN are not used for differential voltage wiring.

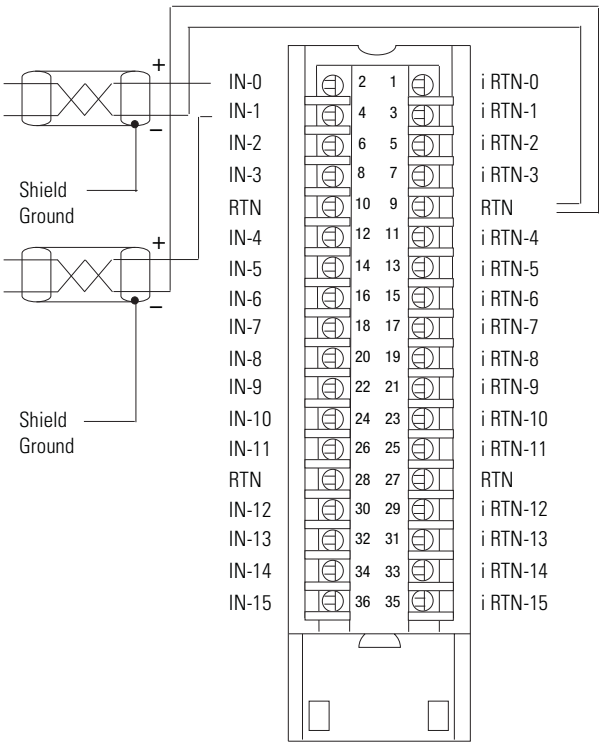
IMPORTANT: When operating in 4 channel, High Speed mode, only use channels 0, 2, 4, and 6.

1756-IF16 Single-ended Current



- All terminals marked RTN are connected internally.
- For current applications, all terminals marked i RTN must be wired to terminals marked RTN.
- A 249 Ω current loop resistor is located between IN-*x* and iRTN-*x* terminals.
- Place additional loop devices (such as strip chart recorders) at the A location in the current loop.

1756-IF16 Single-ended Voltage



- All terminals marked RTN are connected internally.
- Terminals marked i RTN are not used for single-ended voltage wiring.

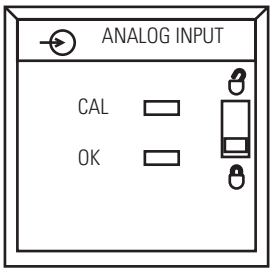


Table 61 - Technical Specifications - 1756-IF16

Attribute	1756-IF16
Inputs	16 single ended, 8 differential or 4 differential (high speed)
Input range	±10V 0…10V 0…5V 0…20 mA
Resolution	320 µV/count (15 bits + sign bipolar) @ ±10.25V 160 µV/count (16 bits) @ 0…10.25V 80 µV/count (16 bits) @ 0…5.125V 0.32 µA/count (16 bits) @ 0…20.5 mA
Current draw @ 5.1V	150 mA
Current draw @ 24V	65 mA
Total backplane power	2.33 W
Power dissipation, max	Voltage: 2.3 W Current: 3.9 W
Thermal dissipation	Voltage: 7.84 BTU/hr Current: 13.3 BTU/hr
Input impedance	Voltage: >10 MΩ Current: 249 Ω
Open circuit detection time	Differential voltage - Positive full scale reading within 5 s Single-ended/differential current - Negative full scale reading within 5 s Single-ended voltage - Even numbered channels go to positive full scale reading within 5 s, odd numbered channels go to negative full scale reading within 5 s
Overvoltage protection, max	Voltage: 30V DC Current: 8V DC
Normal mode noise rejection	>80 dB @ 50/60 Hz(1)
Common mode noise rejection	>100 dB @ 50/60 Hz
Channel bandwidth	15 Hz (-3 dB)(1)
Settling time	<80 ms to 5% of full scale(1)
Calibrated accuracy 25 °C (77 °F)	Voltage: Better than 0.05% of range Current: Better than 0.15% of range
Offset drift	45 µV/°C
Gain drift with temperature	Voltage: 15 ppm/°C Current: 20 ppm/°C
Module error	Voltage: 0.1% of range Current: 0.3% of range
Module input scan time, min	16 pt single-ended: 16…488 ms 8 pt differential: 8…244 ms 4 pt differential: 5…122 ms(1)
On-board data alarming	Yes
Scaling to engineering units	Yes
Real-time channel sampling	Yes
Data format	Integer mode (left justified, 2s complement) IEEE 32-bit floating point
Module conversion method	Sigma-Delta
Isolation voltage	250V (continuous), reinforced insulation type, inputs-to-backplane No isolation between individual inputs Routine tested at 1350V AC for 2 s
Module keying	Electronic, software configurable

Table 61 - Technical Specifications - 1756-IF16 (Continued)

Attribute	1756-IF16
Removable terminal block	1756-TBCH 1756-TBS6H
RTB keying	User-defined mechanical
Slot width	1
Wire category	2(2)
North American temperature code	T4A
IEC temperature code	T4
Enclosure type	None (open-style)

(1) Notch filter dependent.

(2) Use this conductor category information for planning conductor routing as described in the system-level installation manual. See the Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

Table 62 - Environmental Specifications - 1756-IF16

Attribute	1756-IF16
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	0…60 °C (32…140 °F)
Temperature, surrounding air, max	60 °C (140 °F)
Temperature, nonoperating IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-40…85 °C (-40…185 °F)
Relative humidity IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	5…95% noncondensing
Vibration IEC 60068-2-6 (Test Fc, Operating)	2 g @ 10…500 Hz
Shock, operating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	50 g
Emissions	CISPR 11, Class A
ESD immunity IEC 61000-4-2	6 kV contact discharges 8 kV air discharges
Radiated RF immunity IEC 61000-4-3	10V/m with 1 kHz sine-wave 80% AM from 80… 2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 900 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 1890 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000…2700 MHz
EFT/B immunity IEC 61000-4-4	±2 kV at 5 kHz on shielded signal ports
Surge transient immunity IEC 61000-4-5	±2 kV line-earth (CM) on shielded signal ports
Conducted RF immunity IEC 61000-4-6	10V rms with 1 kHz sine-wave 80% AM from 150 kHz…80 MHz on shielded signal ports

Table 63 - Certifications - 1756-IF16

Certification[1]	1756-IF16
UL	UL Listed Industrial Control Equipment. See UL File E65584.
CSA	CSA Certified Process Control Equipment. See CSA File LR54689C. CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations. See CSA File LR69960C.
CE	European Union 2004/108/IEC EMC Directive, compliant with: • EN 61326-1; Meas./Control/Lab., Industrial Requirements • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions • EN 61131-2; Programmable Controllers (Clause 8, Zone A & B) European Union 2006/95/EC LVD, compliant with: EN 61131-2; Programmable Controllers (Clause 11)
C-Tick	Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions
Ex	European Union 94/9/EC ATEX Directive, compliant with: • EN 60079-15; Potentially Explosive Atmospheres, Protection "n" • EN 60079-0; General Requirements II 3 G Ex nA IIC T4 X Gc
FM	FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: Article 58-2 of Radio Waves Act, Clause 3

(1) When marked. See the Product Certification link at http://www.ab.com for Declarations of Conformity, Certificates, and other certification details.

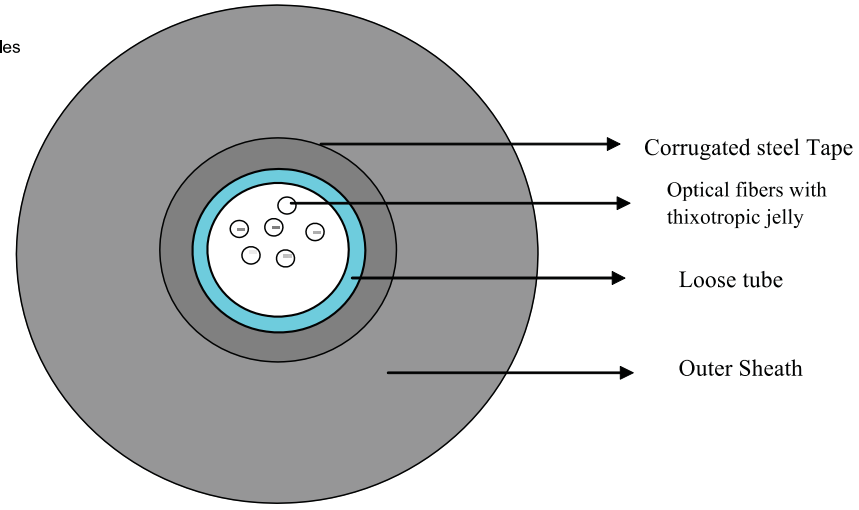
6 Fiber Multi Mode Unitube Cable with Corrugated Steel Armour

Finolex

DATA SHEET

CABLE DESCRIPTION

1 62.5/125 micron Multi-mode Armored Optical Fiber cables
2 Designed with a Loose tube construction
3 Tubes are gel filled to ensure protection against moisture ingress
4 Designed for use in the following applications like Backbone cabling, Campus site cabling & Outdoor Ducts or Direct Burial applications
5 Cable contains upto 6 Fibers
6 Each loose tube contain 6 Optical Fibers
7 HDPE Sheath



SL.No.	PARAMETER	UNIT	SPECIFICATIONS
1	TYPE OF CABLE		6F UNITUBE ARMOURED OPTICAL FIBER CABLE
2	FIBER		MULTIMODE FIBER
a)	FIBER SIZE	um	62.5/125/250 (OM1)
b)	No. OF FIBERS / LOOSE TUBE	No.	6F
c)	FIBER IDENTIFICATION		
	6F		BL, OR, GR, BR, SL & NT
3	OPTICAL PARAMETERS		
	FOR MM		
	ATTENUATION @ 1300nm	dB/Km	≤ 0.7 (MAX)
	ATTENUATION @ 850nm	dB/Km	≤ 2.9 (MAX)
4	LOOSE TUBE / TIGHT BUFFER		LOOSE TUBE
a)	MATERIAL		PBTP
b)	No. OF LOOSE TUBES	No.	1
c)	DIAMETER (Nominal)	mm	2.8
d)	COLOUR OF LOOSE TUBE		NATURAL
e)	SEQUENCE OF ELEMENTS IN CORE		NA
f)	LOOSE TUBE GEL		THIXOTROPIC GEL
5	JACKETING		
a)	MATERIAL		HDPE
b)	COLOUR		BLACK
c)	NOMINAL THICKNESS	mm	2.0
d)	OVERALL DIAMETER (NOMINAL)	mm	8.6
6	ARMOURING		
a)	TYPE		CORRUGATED STEEL TAPE
c)	THICKNESS		> 0.15
7	CABLE WEIGHT (NOMINAL)	Kg/Km	73
8	STANDARD LENGTH	Mtrs	AS PER ORDER
9	TYPE OF PACKING		WOODEN DRUM

GENERAL SPECIFICATIONS:-

01	CABINET SHALL BE FABRICATED FROM COLD ROLLED STEEL SHEET. SHEET THICKNESS: FRONT & REAR DOOR SHALL BE 2 MM THICK. FRAME TOP/BOTTOM/SIDE COVER SHALL BE 1.5 MM. REMOVABLE MOUNTING PLATES SHALL BE 3MM, REMOVABLE GLAND PLATES 3 MM.
02	PANEL PAINT SHADE INTERIOR & EXTERIOR – RAL7035
03	BASE FRAME COLOR SHADE SHALL BE – RAL 7022.
04	MOUNTING PLATE SHALL BE GALVANIZED, 3MM THICK.
05	DEGREE OF PROTECTION I.P.-42
06	DOOR SHALL BE PROJECTED & REMOVABLE TYPE.
07	DOOR SWING SHALL BE 100°-120°.
08	CABLE ENTRY SHALL BE FROM BOTTOM.
09	PANEL SHALL BE FREE STANDING TYPE / WALL MOUNTING & EACH PANEL SHALL HAVE 4 NOS. REMOVABLE LIFTING HOOKS AT TOP.
10	15 MM ANTI-VIBRATION PADS TO WITHSTAND VIBRATION SHALL BE PROVIDED.
11	PANEL INTERNAL WIRING SHALL RUN THROUGH PVC CHANNELS (GREY) WITH COVERS. CABLE DUCT SHALL BE FIRE RETARDANT TYPE AS PER UL 94 VO.
12	TOLERANCE ±5MM OF PANEL DIMENSIONS.
13	CONTROL TERMINALS SHALL BE SCREW LESS / CAGE CLAMP TYPE (MAKE : WAGO / CONNECTWELL) POWER TERMINAL SHALL BE SCREW TYPE (MAKE : WAGO / CONNECTWELL)
14	WIRE (FIRE RETARDANT) SHALL BE OF LAPP / POLYCAB OR EQUIVALENT MAKE.
15	ALL RACKS SHALL BE ISOLATED FROM BODY OF CUBICLE AND GROUNDED.
16	ALL AUXILARIES SHALL BE CONNECTED TO PROTECTIVE EARTH.
17	CROSS FERRULING SCHEME USE FOR WIRING.
18	NAME PLATES: ALUMINIUM / TRAFFOLYTE TYPE.
19	PANEL SHALL BE PROVIDED WITH FANS (REAR TOP) & LOUVERS (FRONT BOTTOM) ON THE DOORS FOR HEAT DISSIPATION / VENTILATION.
20	LED SHALL BE PROVIDED WITH DOOR SWITCH FOR ILLUMINATION.
21	PU / NEOPRENE GASKET WILL BE AROUND DOORS & ROOF TOP AS PER RITTAL's STANDARD.
22	TERMINALS USED FOR INTERCONNECTION OF WIRES INSIDE THE CABINET SHALL BE OF SUITABLE SIZE AS PER WIRE SIZE.
23	CABINET MAKE: RITTAL.
24	DISTANCE BETWEEN CABLE GLAND PLATES & BOTTOM OF TERMINAL STRIPS SHALL BE MINIMUM 300 MM.
25	PARTS MUST CONFORM TO ROCKWELL AUTOMATION ENVIRONMENTAL SPECIFICATION 970-20-01

Please submit proper document

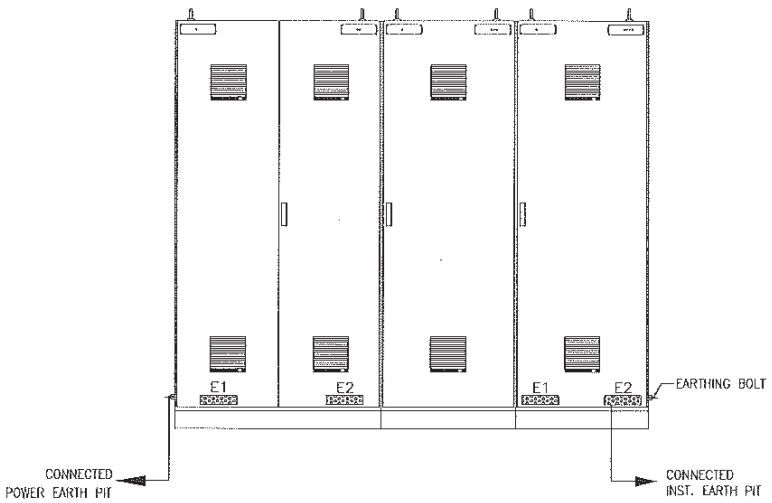
WIRE COLOR & SIZE

DESCRIPTION		COLOR	SIZE
230V AC PHASE	(UPS)	RED	2.5 mm^2
230V AC NEUTRAL	(UPS)	BLACK	2.5 mm^2
230V AC PHASE	(NON UPS)	RED	2.5 mm^2
230V AC NEUTRAL	(NON UPS)	BLACK	2.5 mm^2
EARTH	(POWER EARTH)	GREEN WITH YELLOW	4.0 mm^2
	(INSTRUMENT EARTH)	GREEN	4.0 mm^2
24VDC POSITIVE		BLUE (UP TO TB BUS)	AS PER TABLE-A
		BLUE (FROM TB BUS)	1.0 mm^2
24VDC NEGATIVE		WHITE (UP TO TB BUS)	AS PER TABLE-A
		WHITE (FROM TB BUS)	1.0 mm^2
DIGITAL INPUT SIGNAL		BLUE (VOLTAGE)	0.5 mm^2
		YELLOW (SIGNAL)	0.5 mm^2
DIGITAL OUTPUT SIGNAL		ORANGE (SIGNAL)	0.5 mm^2
		WHITE (RETURN)	0.5 mm^2
RELAY CONTACT SIGNAL (POTENTIAL FREE)		GREY	1.0 mm^2
RELAY CONTACT SIGNAL (24V DC)		BLUE	1.0 mm^2
RELAY CONTACT SIGNAL (230/110V AC)		RED	1.0 mm^2
RELAY CONTACT SIGNAL (110V DC)		VIOLET	1.0 mm^2
ANALOG INPUT SIGNAL		BLUE (VOLTAGE)	0.5 mm^2
		RED (SIGNAL)	0.5 mm^2
		WHITE (RETURN)	0.5 mm^2
ANALOG OUTPUT SIGNAL		BROWN	0.5 mm^2
THERMOCOUPLE		BROWN	0.5 mm^2
RTD		PINK (RETURN)	0.5 mm^2
		WHITE (LOW SIGNAL)	0.5 mm^2
		WHITE (HIGH SIGNAL)	0.5 mm^2

TABLE-A (WIRE SIZE BASED MAXIMUM CURRENT RATING)

UP TO 10A	2.5 mm^2
11A TO 20A	4.0 mm^2
21A TO 30A	6.0 mm^2
31A TO 40A	10 mm^2

EARTHING DETAILS IN THE PANELS



GENERAL NOTES :-

1. AFTER LAYING THE EARTH STRIP FROM THE EARTHBUS TO THE ELECTRODE THROUGH THE PVC CONDUIT AT THE PIT ENTRY CONDUIT SHOULD BE SEALED WITH BITUMIN COMPOUND

SPECIFIC NOTES :-

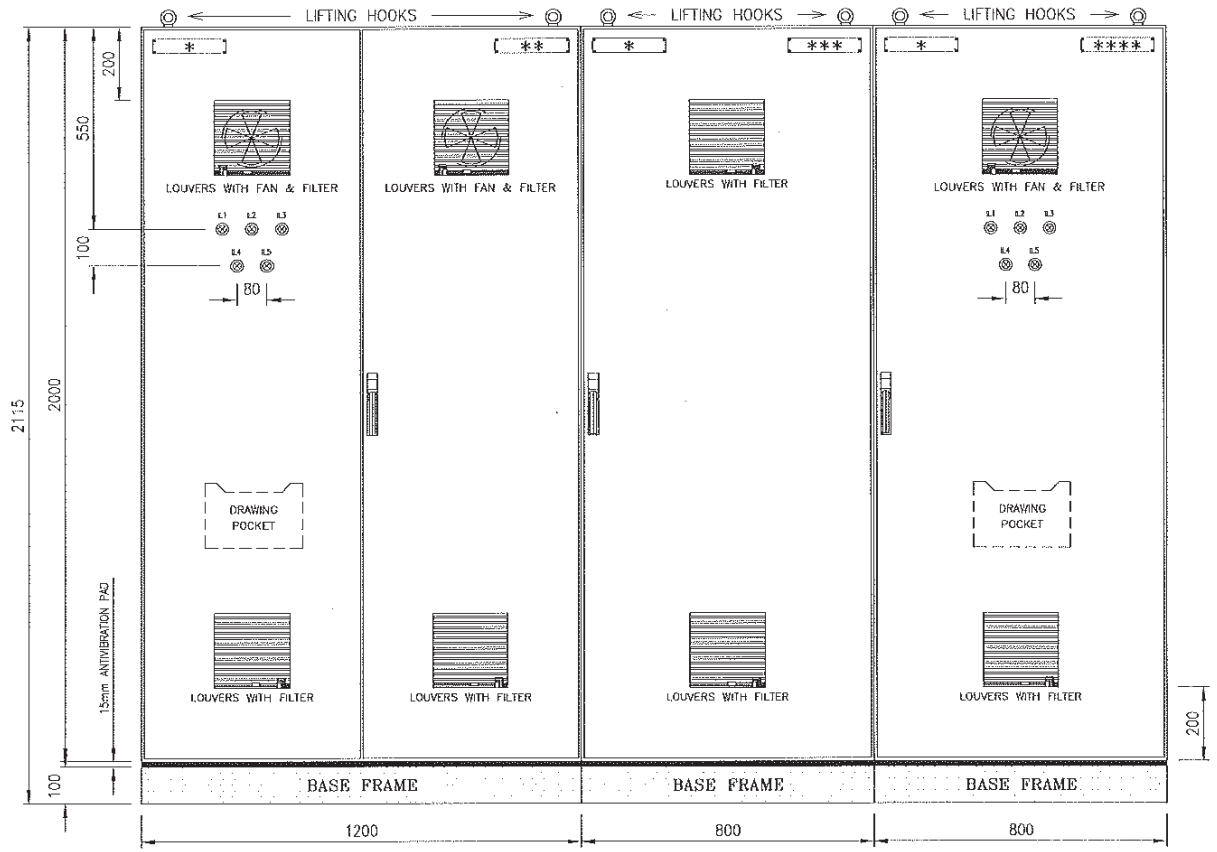
1. NO. OF EARTH BUSBAR - 2 NOS.
   E1 - POWER EARTH
   E2 - INSTRUMENT EARTH
2. THE EARTH PITS (INSTRUMENT & POWER) SHALL BE TOTALLY ISOLATED FROM EACH OTHER.
3. FOR POWER EARTH RESISTANCE SHALL BE LESS THAN 1 OHMS.
   FOR INSTRUMENT EARTH RESISTANCE SHALL BE LESS THAN 5 OHMS.
4. EARTHING CABLE SIZE OUTSIDE ENCLOSURE SHALL BE 16 SQMM.

POWER EARTH CONNECTION DETAILS :
- ENCLOSURES
- UTILITY SOCKET
- RA CHASSIS
- RA RACK POWER SUPPLIES INPUT
- SMPS INPUT

INSTRUMENT EARTH CONNECTION DETAILS :
- INSTRUMENT SHIELD FROM FIELD CABLE.

NOTE :-

1. INSTRUMENT EARTHING BUSBAR IN SIDE THE PANEL IS HAVING M10 SIZE EARTHING HOLE WHICH WILL BE CONNECTED TO MAIN INSTRUMENT EARTHING PIT.
2. POWER EARTHING BUSBAR IN SIDE THE PANEL IS HAVING M10 SIZE EARTHING HOLE WHICH WILL BE CONNECTED TO EARTHING BOLT & SAME SHALL BE CONNECTED TO MAIN POWER EARTHING PIT.



FRONT VIEW (EXTERNAL)

NAME PLATE DETAILS :-

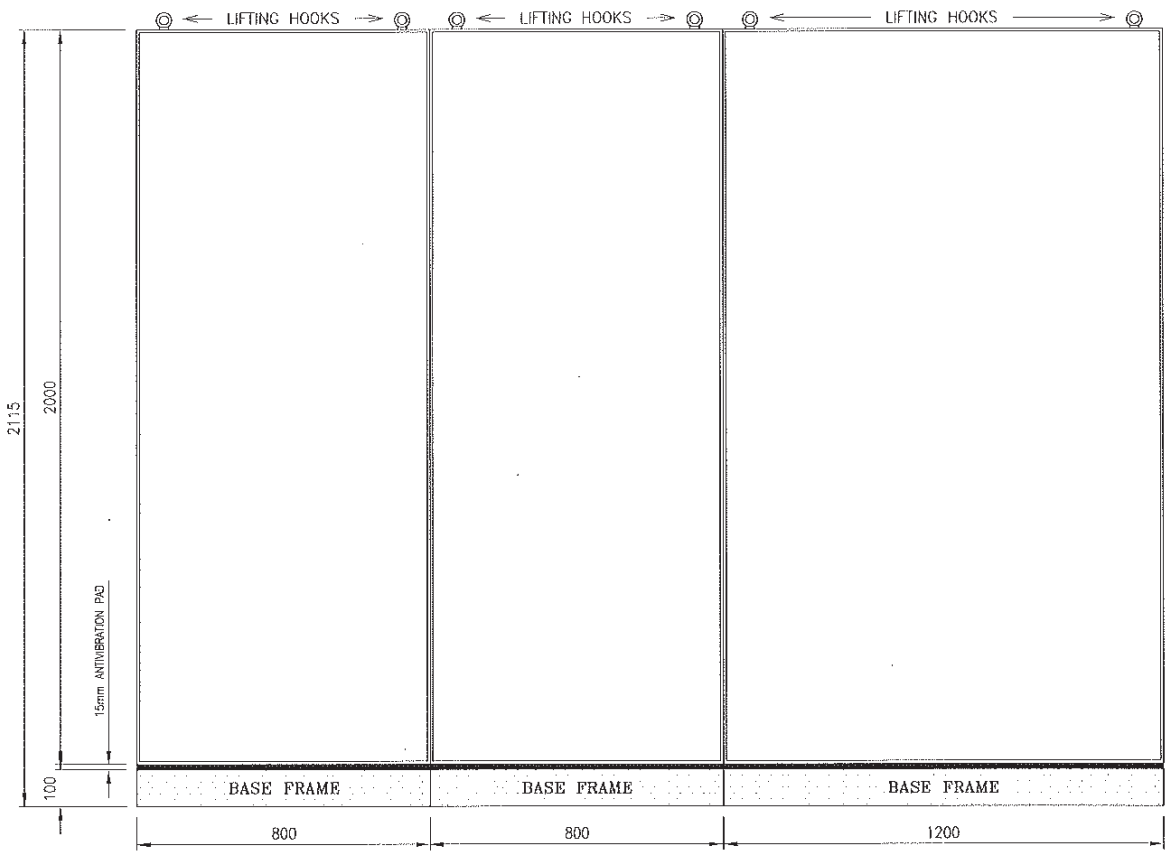
* – Rockwell Automation

** – RIO PANEL 18 (PLC 102) (COB#1)

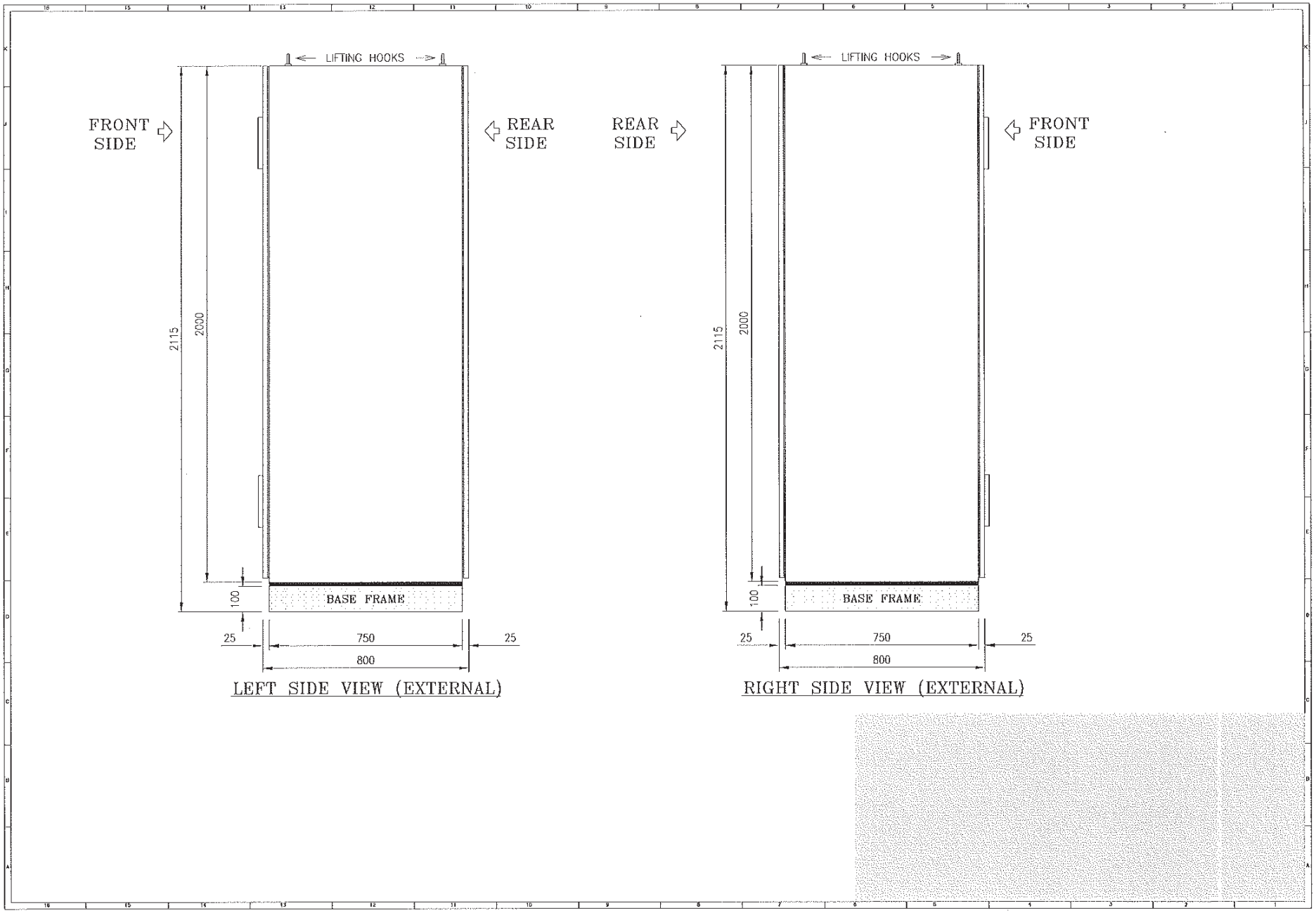
*** – MARSHALLING PANEL RIO18 (PLC102 & PLC202)

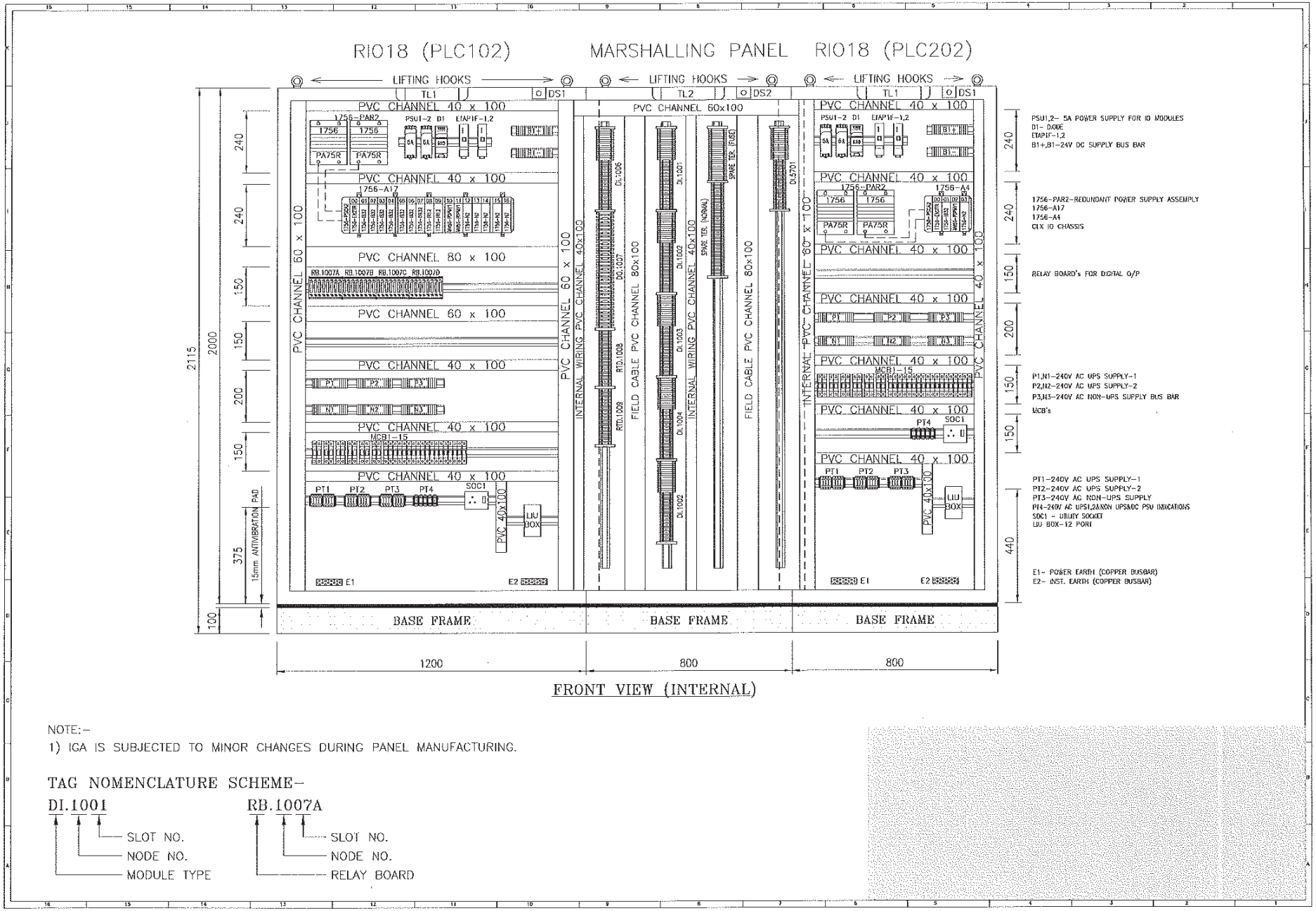
**** – RIO PANEL 18 (PLC 202) (COB#2)

TAG NO	DESCRIPTION
IL1	UPS-1 POWER ON (GREEN)
IL2	UPS-2 POWER ON (GREEN)
IL3	NON - UPS POWER ON (AMBER)
IL4	DC POWER -1 ON (RED)
IL5	DC POWER -2 ON (RED)



REAR VIEW (EXTERNAL CLOSED)


LIFTING HOOKS
FRONT SIDE
REAR SIDE
2115
2000
100
BASE FRAME
25
750
25
800
LEFT SIDE VIEW (EXTERNAL)
LIFTING HOOKS
REAR SIDE
FRONT SIDE
2115
2000
100
BASE FRAME
25
750
25
800
RIGHT SIDE VIEW (EXTERNAL)



FRONT VIEW (INTERNAL)

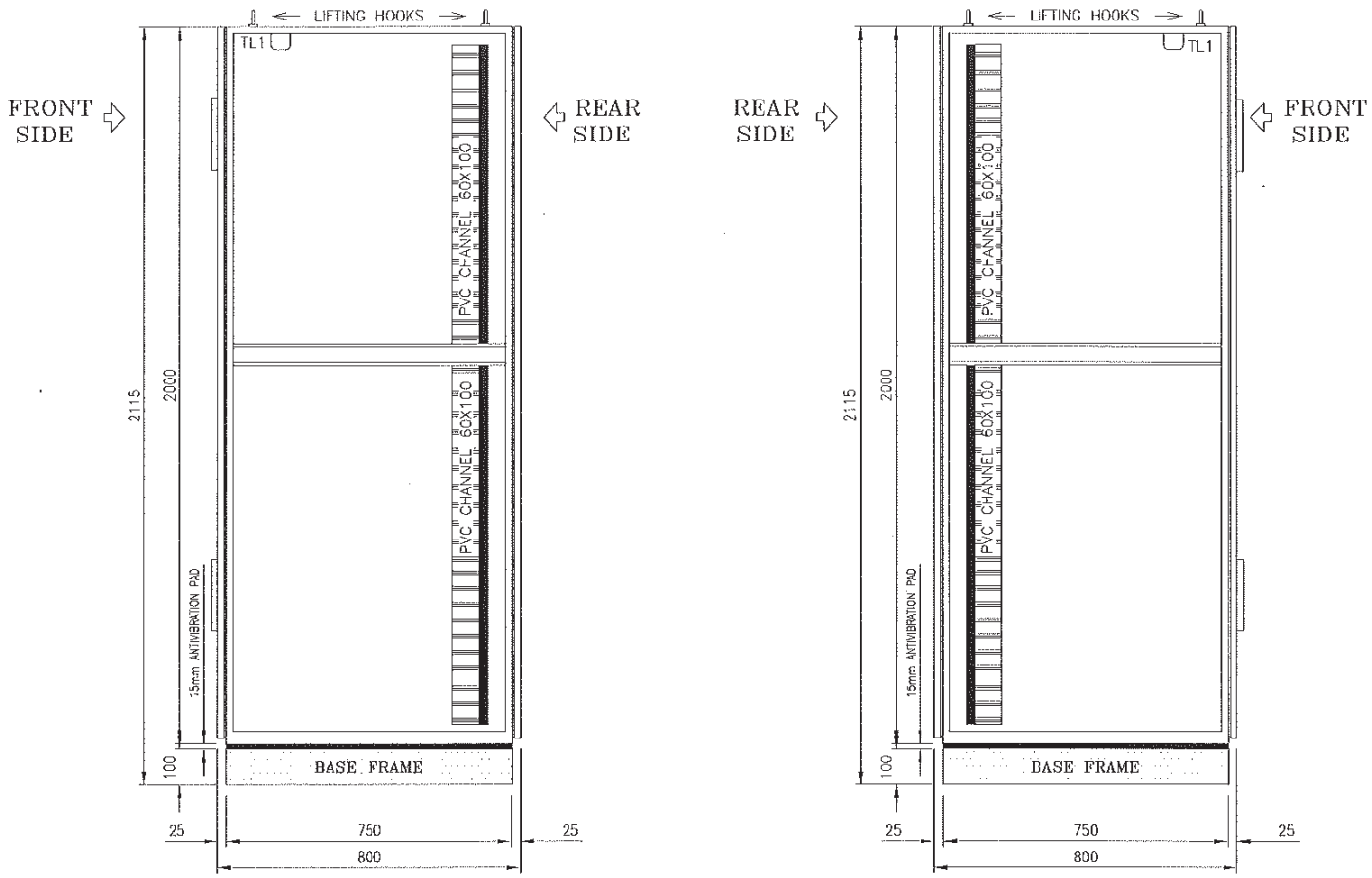
NOTE:-

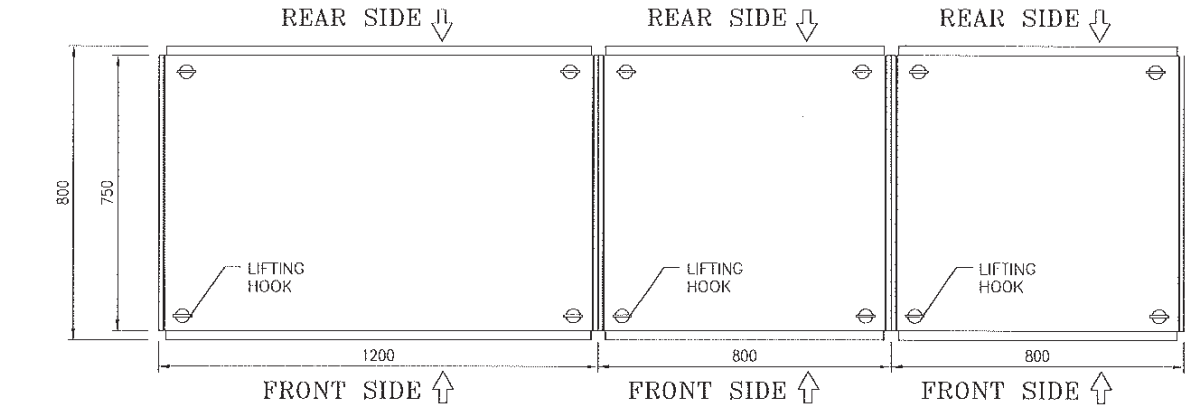
1) IGA IS SUBJECTED TO MINOR CHANGES DURING PANEL MANUFACTURING.

TAG NOMENCLATURE SCHEME-

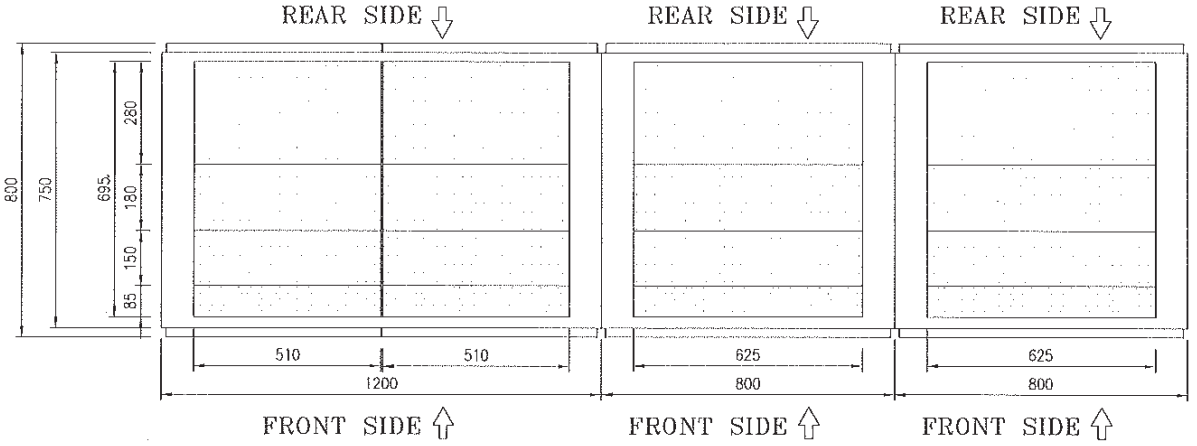
DI.1001
- SLOT NO.
- NODE NO.
- MODULE TYPE

RB.1007A
- SLOT NO.
- NODE NO.
- RELAY BOARD

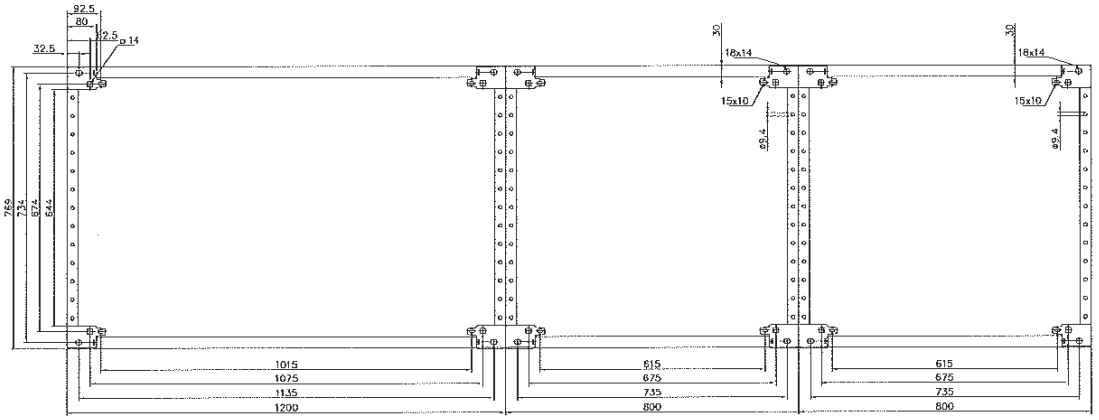

LIFTING HOOKS
TL1
FRONT SIDE
REAR SIDE
PVC "H" CHANNEL 60X100
PVC "H" CHANNEL 60X100
2115
2000
15mm ANTIVIBRATION PAD
100
BASE FRAME
25
750
25
800
LEFT SIDE VIEW (INTERNAL)
LIFTING HOOKS
TL1
REAR SIDE
FRONT SIDE
PVC "H" CHANNEL 60X100
PVC "H" CHANNEL 60X100
2115
2000
15mm ANTIVIBRATION PAD
100
BASE FRAME
25
750
25
800
RIGHT SIDE VIEW (INTERNAL)



TOP VIEW (WITH SHEET)



BOTTOM VIEW (WITH GLAND PLATE)



TOP VIEW (BASE FRAME)

PLINTH 1200 x 769 x 100 PLINTH 800 x 769 x 100 PLINTH 800 x 769 x 100

FRONT VIEW FRONT VIEW FRONT VIEW

BASE FRAME DETAILS

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

REV	DATE	ALTERED: / CHECKED:	REV	DATE	ALTERED / CHECKED

APPROVED WITH COMMENTS

STATUS : CONTRACT

JOB NO.: 412

FALGUNI SAHA 2020.10.22 08:56:27 +05'30'

BHARAT HEAVY ELECTRICALS LTD PROJECT ENGINEERING MANAGEMENT

The approval status shall be interpreted as laid down in the contract and it shall not relieve the contractor from the contractual obligations.

APPROVAL CATEGORY AWARDED = II

CAT I - Approved

CAT II - Approved With Comments as Noted

CAT III - Not Approved

CAT IV - Reference Drawing

DEPARTMENT: MECHANICAL AUXILIARY

NAME: FALGUNI SAHA

2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

BHARAT HEAVY ELECTRICALS LIMITED
PROJECTS ENGINEERING MANAGEMENT, NOIDA.

BHEL DWG NO. PE-V11-412-174-A126

SUB CONTRACTOR: DENORA INDIA LTD

ASSOCIATE PARTNER: DENORA WATER TECHNOLOGIES SINGAPORE

LOA NO: PW/PE/PG/EN1/P-24/17 DATED: 22 APR 2017

DEPT.	CODE		SCALE	WEIGHT(KG)	REF DRG.	ITEM
--	A		-	-	-	-

QAP/ FAT - PLC FOR ELCTROCHLORINATION PLANT

	NAME	SIGN	DATE
PREP	SN		10.02.2020
CHKD	PG		10.02.2020
APPD	RF		10.02.2020

DEPT.							CARD CODE
SIGN			N.A.				-
DATE							

BHEL DOC NO: PE-V11-412-174-A126

REV 1

NO. OF SHEETS 23 XCLUDING COVER PAGE

TAMILNADU GENERATION AND DISTRIBUTION CORPORATION LTD

From	To
Er. S.SUYA JOTHI, B.E., Superintending Engineer/Electrical/ Project I, TANGEDCO,5th Floor, Western wing, 144,NPKRRMaaligai, Anna salai, Chennai-2 E.Mail : sepr1@tnebnet.org Mobile : 9445859001	Bharat Heavy Electricals Limited, POWER PROJECT ENGINEERING INSTITUTE HRD & ESI COMPLEX NOIDA - 201301(U.P)

Lr.No.SE/E/Pr.I/EE2/AEE/F.BHEL/PEM/ D. 1252 /20 dtd. 21 .10.2020

Project Title	2x660 MW ENNORE SEZ Supercritical TPP
TANGEDCO REFERENCE No.	LOA. Lr.No. CE/P/SE/M/P/EE-10/E/P/F.2x660 MW Ennore SEZ STPP/D.60/14, dt.27.09.2014
BHEL Reference No:	1. BHEL Email dated 14.02.2020 2. Desein Comment Ref.No .D.4027/TANGEDCO/7722 dt 18.02.2020
Subject	TANGEDCO – Comments- QAP/FAT AND SAT PROCEDURE FOR PLC for Electro chlorination PlantDocuments / Drawings received from BHEL / PEM- Reg

Sir,
The Comments on the drawing/document submitted by M/s BHEL on the above subject vide BHEL transmittal under reference is furnished below.

Sl. No	DRG/DOC.No:	DESCRIPTION	Rev No.	Status	Remarks
01	PE-V11-412-174-A126	QAP/FAT AND SAT PROCEDURE FOR PLC for Electro chlorination Plant	01	03	M/s. BHEL is requested to submit the revised documents/ drawings after suitably incorporating the comments

Status : Category **1**- Approved. Category: **2** – Approved with comments, Resubmit for approval under, Category **1**. Category **3** – Not approved (See attachment Memo) Resubmit for approval. Category **4** – Information furnished is noted.

Yours faithfully,

---sd(20.10.20)---
SuperintendingEngineer/E/Projects-I

Copy to Shri E.V. Anand/DESEIN Consultants India Pvt. Ltd.,DESEIN HOUSE,Greater Kailash-II New Delhi-48 (E-Mail)
Copy submitted to The Chief Engineer/Civil/Ennore SEZ/Chennai 600120.(E-Mail)