TECHNICAL PROCUREMENT SPECIFICATION	32644-02-PS-002
	PAGE 1 OF 1

TPS No:	**32644-02-PS-002**
STATUS	ENQUIRY
ORIGINATING DEPT.	M&PCE
P.O / W.O No:	
PROJECT	CONSTRUCTION OF PHOSPHORIC ACID STORAGE TANKS AND ASSOCIATED FACILITIES AT Q10 BERTH, WI.
LOCATION	W. ISLAND
CLIENT	FACT-CD
PURCHASER	FACT-CD
VENDOR	

CENTRIFUGAL PUMPS FOR PHOSPHORIC ACID SERVICE			
1.0	**PHOSPHORIC ACID TRANSFER PUMPS**	**P-3202A/B**	**2 Nos.**
2.0	**PHOSPHORIC ACID SUMP PUMPS**	**P-3203A/B**	**2 Nos.**
3.0	**RAIN WATER PIT PUMP**	**P-3204**	**1 No.**

0	For Enquiry	LA	SK	AAN	17.02.2021
Rev.	Details	By	Chkd	Apprd	Date

FACT ENGINEERING AND DESIGN ORGANISATION FEDO

TECHNICAL PROCUREMENT SPECIFICATION	ATTACHMENTS	32644-02-PS-002AT
		PAGE 1 OF 1

TPS No. : 32644-02-PS-002

S.No.	Doc. No.	Description	No. of pages	Rev. No. with Issue					
				1	2	3	4	5	6
1	32644-02-PS-002 IS	Equipment / Items to be Supplied	1	0					
2	32644-02-PS-002 SW	Scope of Work - Mechanical	2	0					
3	32644-02-PS-002 SW ELEC	Scope of Work - Electrical	1	0					
4	32644-02-PS-002 SPL	Special Requirement of the Project	5	0					
5	32644-02-PS-002 VDR	Vendor Data Requirements - Mechanical	1	0					
6	32644-02-PS-002 VDR ELEC	Vendor Data Requirements - Electrical	1	0					
7	32644-02-PS-002 INS	Scope of Inspection and Tests - Mechanical	1	0					
8	32644-02-PS-002 INS ELEC	Scope of Inspection and Tests - Electrical	1	0					
9	32644-02-PS-002 VDI	Vendor Data Index	1	0					
10	32644-02-PS-002 SPR(M)	Spares - Mandatory	1	0					
11	32644-02-PS-002 SPR(OP)	Spares - 2 year operational	1	0					
12	32644-02-PS-002 SPR(CO)	Spares - Commissioning (Format)	1	0					
13	32644-02-PS-002 LD	Equipment Lubrication data sheet	1	-					
14	32644-02-PS-002 CS	Compliance Statement	1	-					
	PROCESS DATA SHEETS								
15	32644-11-SE-P3202A/B	Phosphoric Acid Transfer Pumps (P-3202A/B)	1	2					
16	32644-11-SE-P3203	Phosphoric Acid Sump Pumps (P-3203A/B)	1	2					
17	32644-11-SE-P3204	Rain Water Pit Pump (P-3204)	1	1					
	MECHANICAL DATA SHEETS								
18	32644-01-DA-001	Phosphoric Acid Transfer Pumps (P-3202A/B)	3	0					
19	32644-01-DA-002	Phosphoric Acid Sump Pumps (P-3203A/B)	5	0					
20	32644-01-DA-003	Rain Water Pit Pump (P-3204)	3	0					
	ELECTRICAL								
21	32644-13-DA-90002	General Requirements for Electrics	1	0					
22	32644-13-DA-91001	Medium Voltage Induction Motors	2	0					
23	32644-13-TP-91001	Technical Particulars MV Induction Motors	3	0					
	DRAWINGS								
24	32644-11-PD-001	P&ID for proposed Phosphoric Acid Storage Tanks	1	4					
25	32644-11-PD-002	P&ID for proposed Rain Water & Sump Pit	1	2					
	ENGINEERING SPECIFICATIONS								
26	02 ES 001 / 2010	Vendor Data Submission Procedure	4	-					
27	01ES 010 / 94	Centrifugal Pump for General Purpose	7	-					
28	13ES 910 / 14	Medium Voltage Induction Motors	6	-					
29	13ES 900 / 14	General Requirements for Electrics	4	-					
	PRICE BID								
30	32644-02-PS-002 SIW	Schedule of Items of Work	1	0					

Note :
1. The receipt of all attachments shall be checked and asertained.
2. All attachments of this TPS shall be retained since only revised sheets, if any, shall be issued.

REV.NO.	DATE	DESCRIPTION	PREPD	CHKD	APPRD
0	17.02.2021	For Enquiry	LA	SK	AAN

FACT ENGINEERING AND DESIGN ORGANISATION

FEDO

TECHNICAL PROCUREMENT SPECIFICATION	EQUIPMENT / ITEMS TO BE SUPPLIED	32644-02-PS-002 IS
		PAGE 1 OF 1

TPS NO. 32644-02-PS-002

Sl. No.	Eqpt. No. / Tag No.	Description	Qty. Nos.	Remarks
		CENTRIFUGAL PUMPS FOR PHOSHORIC ACID SERVICE		
1	P-3202A/B	Phosphoric Acid Transfer Pumps	2	1W + 1 S (Horizontal)
2	P-3203A/B	Phosphoric Acid Sump Pumps	2	1 W + 1 S (Vertical)
3	P-3204	Rain Water Pit Pump	1	1 W (Horizontal)

REV.NO.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED
0	17-02-21	For Enquiry	LA	SK	AAN

FACT ENGINEERING AND DESIGN ORGANISATION

TECHNICAL PROCUREMENT SPECIFICATION	SCOPE OF WORK (Mechanical)	32644-02-PS-002 SW
		PAGE 1 OF 2

TPS NO.	32644-02-PS-002
ITEM :	**CENTRIFUGAL PUMPS**
EQPT. NO.	P-3202A/B, P-3203A/B, P-3204

The scope of work for the equipments listed above shall include design,manufacture ,supply of materials and engineering work as detailed below.

Sl. No	Description	Reqd.	Remarks
1.0	Pump	X	
2.0	Auxiliary piping within the confines of the baseplate		
	Casing drain and vent piping with valve & flanged connection	X	
	Cooling water piping inlet & outlet valves with flanged connection	X	If Applicable
	Self or external flushing piping with flanged connection	X	If Applicable
	Quench water or steam piping with flanged connection & traps	X	For jacketed pumps
3.0	Coupling with nonspark coupling guard		
	Between pump and driver	X	
	Between pump and gear		
	Between gear and driver		
4.0	Base		
4.1	Common baseplate		
	For pump & driver	X	
	For pump & gear		
	For pump, gear & driver		
4.2	Separate baseplate		
4.3	Mounting flange for pump		
5.0	Lube oil system	X	
5.1	Common oil system for pump and gear / driver	X	As applicable
5.2	Oil system for pump only		
5.3	Complete lube oil system including		
	Shaft driven main pump		
	Motor driven standby pump		
5.4	Interconnecting lube oil piping	X	
	Between oil console and pump		
6.0	Gear unit		
7.0	Inspection and testing	X	

REV.NO.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED
0	17-02-2021	FOR ENQUIRY	LA	SK	AAN

Sl. No	Description	Reqd.	Remarks
8.0	Painting		
	Prime coating only		
	Prime coating and finish paint	X	
9.0	Packing		
	Domestic packing	X	
	Export packing	X	If applicable
	Rust prevention for long term storage	X	6 months
10.0	Special tools	X	If any
11.0	Spare parts		
	Construction and commissioning	X	
	Mandatory Spares	X	
	Two years operation - (Purchaser reserves full right to purchase or not to purchase the item fully or partially as per rate quoted by the vendor.)	X	(Shall not be considered for price bid evaluation)
12.0	Foundation bolts and nuts	X	MoC - SS 316L
13.0	Driver		
	Main electric motor for pump	X	
14.0	Mounting driver		
	Mounting driver on baseplate	X	
	Mounting driver half coupling	X	
	Provide shim plates and set bolts for mounting driver	X	
15.0	Miscellaneous		
	Noise attenuation cover	*	* (If required)
	Level switch for sump pump		
	Strainer for sump pump suction	X	
	Minimum flow recirculation valve		
	~~Mechanical Seal~~ Gland Packing (Non asbestos)	X	
16.0	Super vision for Erection	X	
17.0	Super vision for SAT/PGTR	X	
18.0	Supervision for Commissioning	X	
19.0	Drawings & documents	X	As per VDR

TECHNICAL PROCUREMENT SPECIFICATION	SCOPE OF WORK	32644-02-PS-002SW ELEC	
		Page 1 of 1	R0

TPS NO.	**32644-02-PS-002**
ITEM :	**Drive motors for Phosphoric Acid Transfer pumps, Phosphoric Acid Sump pump and Rain water pit pump**
EQPT. NO.	**P-3202 A/B, P-3203 A/B, P-3204**

The Scope of work include the following

Sl.No.	Description	Required	Remarks
	ELECTRICS		
1.0	Design, detailed engineering, manufacturing, testing at works and supply of all electrics required for the package, fully conforming to the attached specification and data sheets, including but not limited to the following:-	**YES**	
1.1	Medium Voltage squirrel cage induction motors including all accessories and spares	**YES**	
2.0	Arranging for Inspection & Tests as per “Scope of Inspection & Tests” attached	**YES**	
3.0	Furnishing all documents as per “ Vendor Data Requirements” attached	**YES**	

REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED
0	12-02-‘21	Issued for enquiry	LN	SM	IK

1.0 INTRODUCTION

1.1 FACT-CD has proposes to install 2 nos. additional Phosphoric Acid Storage Tanks & associated facilities at W. Island adjacent to the existing three tanks for the purpose of improving the Phosphoric Acid handling capability as part of new NP Plant.

1.2 2 Nos. of Phosphoric acid truck loading pumps (1W+ 1S) with drive motors, 2 Nos. Phosphoric acid sump pump (1W+1S) with drive motor, and 1 No. Rain Water pit pump with drive motor, with all accessories for these pumps are required as part of aforesaid facility at Q10 Berth, WI. Kochi.

1.3 The scope of work of the Vendor shall include the Design, Manufacture, Inspection, Testing, Painting, Insurance, Supply of the equipment with all accessories, Training of owner's personnel and Handing over the system to M/s. FACT- Cochin Division as per the Technical Procurement Specification.

2.0 GENERAL

2.1 All documents as detailed in 'Vendor Data Submission Procedure" & "Vendor Data Requirements" shall be submitted by Vendor for review by FEDO.

2.2 All items indicated in "Scope of Work" attached shall be included in the Scope of Vendor. Any item required for the safe and efficient operation of the system whether specifically mentioned or not, shall be provided by Vendor without extra cost.

2.3 Inspection / Tests shall be carried out by Vendor as detailed in "Scope of Inspection and Tests". Witnessing of tests where specified will be done by FACT/ FEDO or their authorized representative.

2.4 Data sheets of Pumps are enclosed. Pump Manufacturer shall submit all data sheets duly filled up along with other documents/drawings indicated in "Vendor Data Requirements", along with the offer. Changes if any required for meeting system /operational requirements shall be indicated along with reasons thereof.

2.5 First Fill of Lubricant, Mandatory Spares, Start-up and Commissioning spares, spares for two years normal operation and Consumables for Testing, Commissioning and establishing Guarantees shall be included in the scope of the Vendor.

2.6 Special tools required if any, for the normal operation and maintenance of the equipment shall be included in the scope of the Vendor. Details of such special tools shall be furnished.

2.7 All equipment shall be properly tagged, packed, securely anchored and protected for domestic shipment by rail / truck or suitable for ocean transport as the case may be. Rust inhibitors shall be

applied to the equipment to prevent rusting during shipment and site storage for minimum of 6 months.

2.8 Vendor shall submit a procedure/methodology for the Site Acceptance Test(SAT)/Performance Guarantee Test Run (PGTR) in the offer stage itself.

2.9 Vendor shall submit a Quality Assurance Policy for the system in the offer stage itself.

2.10 The equipment shall be as per BS / IS standard.

2.11 All safety devices to protect the equipment from damage due to conditions of overload shall be incorporated as per standard practice.

2.12 Corrosion allowance on carbon steel parts of equipment shall be 3 mm on thickness unless otherwise specified.

2.13 Deviations if any from the Specifications shall be clearly spelt out in the "Compliance Statement" attached failing which it will be taken to understand that there are no deviations from the Specifications.

3.0 TECHNICAL

3.1 Design and documents of the system shall be in accordance with BS / IS standard.

3.2 Pumps duty shall be continuous.

3.3 Pumps shall have stable head / flow rate curves (continuous head rise to shutoff) for all applications. If parallel operation is specified, the head rise from rated point to shutoff shall be at least 10%. Unless otherwise specified, discharge orifice shall not be used to achieve required head rise to shut off in case of parallel operation.

3.4 Unless specified otherwise, the maximum permissible sound level shall not exceed 85 dBA measured at one (1) meter from the complete pump unit, when measured in any direction & from any point of any equipment surface located on the equipment skid, for the recommended range of operation.

3.5 Data sheets of Pumps are enclosed. All the specifications/ parameters specified in the data sheet are the minimum requirements to be established by the Pump Manufacturer. Any additional requirements/changes required for the safe and satisfactory functioning of the equipment shall be indicated along with reasons thereof in the offer stage itself.

3.6 Pump shut-off pressure should not exceed 20% of rated discharge pressure.

3.7 Pumps offered shall have a minimum margin of NPSHA over NPSHR of 0.6 meter.

3.8 By changing the impeller it should be possible to attain 5% increase in discharge head over rated discharge head.

3.9 Pumps shall be tested at shop with job motor in presence of authorized representative of FACT / FEDO.

3.10 Base plate shall cover full length of pump and motor.

3.11 Pump shall be designed to withstand the external forces and moments calculated in accordance with API 610.

3.12 Pump manufacturer shall indicate Latest ASTM material designation for the parts used for the equipment and accessories, etc.

3.13 Pump manufacturer to include any additional accessory and / or material in their scope of supply required to meet the specified performance and guarantees, for satisfactory operation of equipment, safe and reliable start up, normal shut down and emergency shut down and state the same in specification sheet attached to the technical offer

3.14 Equipment shall be with direct drive without gear box.

3.15 For Electrics, specification indicated elsewhere in this Tender shall be followed.

3.16 Area of classification – Non Hazardous

3.17 Unless otherwise specified, equipment shall be designed to be suitable for outdoor installation without a roof.

3.18 Pump manufacturer shall establish all guarantees as specified. Defect or shortfall in performance shall be rectified by the Pump manufacturer within reasonable time failing which Purchaser (Owner) will make arrangements to rectify the same at the risk and cost of the manufacturer. All Performance parameters specified in the data sheets, special requirements and engineering specifications including Head and capacity of the pump at rated point without negative tolerance, NPSHR requirements, shut off head, power consumption etc shall be guaranteed.

4.0 SPARE PARTS

4.1 GENERAL

4.1.1 The bidder shall include in his scope of supply all the start-up and commissioning spares, mandatory spares and recommended two years operation spares and indicate these in the relevant schedules. The general requirements pertaining to the supply of these spares is given below:

4.1.2 The Manufacturer shall also indicate the unit wise population of each item and the service expectancy period for the spare parts under normal operating conditions before order placement.

4.1.3 All spares supplied under this contract shall be strictly interchangeable with the parts for which they are intended for replacements. The spares shall be treated and packed for long storage under the climatic conditions prevailing at the site, e.g. small items shall be packed in sealed transparent plastic bags with dissector packs as necessary.

4.1.4 Each spare part shall be clearly marked or labeled on the outside of the packing with the description. When more than one spare part is packed in single case, a general description of contents shall be on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purpose of identification.

4.1.5 The Manufacturer shall provide the purchaser all the addresses and specification of his sub-suppliers while placing the order on vendors for items / components / equipment covered under purchase order and will further ensure with his vendors that the purchaser, if so desires, will have the right to place order for spares directly on them on mutually agreed terms based on offers of such vendors.

4.1.6 No Mandatory spares and recommended spares for 2 years will be used during startup and commissioning of the equipment.

4.2 MANDATORY SPARES PARTS

4.2.1 The mandatory spares, which are considered as essential by the purchaser are listed and attached with the Enquiry.

4.2.2 The prices of mandatory spares indicated by the bidder in the Bid Proposal shall be used for bid evaluation purposes.

4.3 RECOMMENDED SPARES FOR 2 YEARS OPERATION

4.3.1 The Bidders shall submit the list including unit & quantity of recommended spares for two years normal operation & maintenance in un-priced part as per format and item wise price shall be submitted in priced part.

4.3.2 The Purchaser reserves the right to buy any or all recommended spares.

4.3.3 Prices of recommended spares will not be used for the evaluation of Bids. Prices of Spares shall remain valid for two years from the end of guarantee period; Owner may order such spares any time during this period.

4.4 START-UP & COMMISSIONING SPARES

4.4.1 Commissioning spare parts shall be procured and supplied along with the main equipment as per equipment manufacturer's recommendations. The list of such recommended spares shall be obtained along with the offer. Any commissioning spares consumed over and above the recommended commissioning spare, during commissioning shall be supplied free of cost by the equipment vendor. Any leftover (unused) spares after commissioning, out of those included by vendor in his offer, shall be handed over to the Owner.

5.0 TESTING & INSPECTION:

5.1 Pump testing shall be in accordance with API 610.

5.2 All equipment shall be subjected to inspection by Owner / authorized representative at all stages, before, during and after manufacture.

5.3 Owner or their representative shall have free access to the works of the Vendor to carry out the inspection of all items covered under the scope of work. Vendor shall submit a detailed quality assurance plan for review and approval by FEDO/FACT.

5.4 Equipment shall be tested at shop in the presence of authorized representative of FACT / FEDO.

5.5 Approval of work by FEDO / FACT shall in no way relieve the Vendor of his responsibility in meeting all the provisions of the enquiry conditions.

5.6 Bidders shall provide a minimum of 10 days advance notice to Owner to arrange the inspection as per agreed QAP / Inspection Test Plan (ITP).

6.0 PAINTING & PROTECTION:

6.1 All exposed parts other than SS / Machined surfaces, prior to painting, shall be blast cleaned to SA 2½ in an environment of relative humidity not exceeding 80%.

6.2 After surface preparation the protective painting shall done on all exposed parts other than SS as follows,

a) Primer (at shop) : One coat of anti corrosive epoxy primer @ 50 µ DFT (min).

b) Intermediate coat (at shop) : One coat of anti corrosive epoxy paint @ 50 µ DFT(min)

c) Finish coat (at site) : One coat of anti corrosive epoxy paint @ 50 µ DFT(min).

6.3 All exposed machined surfaces and internals shall be protected against rusting, before dispatch, suitable for 6 months of storage.

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TECHNICAL PROCUREMENT SPECIFICATION	VENDOR DATA REQUIREMENTS (Phosphoric Acid Pump)	32644-02-PS-002 VDR
		PAGE 1 OF 1

PROJECT : CONSTRUCTION OF PHOSPHORIC ACID STORAGE TANKS AND ASSOCIATED FACILITIES AT Q10 BERTH, WI.

ITEM : **CENTRIFUGAL PUMPS P-3202A/B, P-3203A/B, P-3204**

CLIENT : FACT CD

TPS No : 32644-02-PS-002

STATUS : [x] ENQUIRY [ ] COMMITMENT **PO No :**

Sl. No	Grp Code	Description	Offer	After Commitment				Final@@
			Qty	Qty	Lead time in weeks			Qty
					Reqd	Prop@	Agrd	
1.0	A	Data sheets	1S	1S	4			4P+1S
2.0	A	Predicted performance curves	1S	1S	4			4P+1S
3.0	A	Dimensioned G. A drawings	1S	1S	4			4P+1S
4.0	A	Foundation plan with load details		1S	4			4P+1S
5.0	A	Foundation bolt details		1S	4			
6.0	B	Cross section drawing with list of parts and material of construction	1S	1S	4			4P+1S
~~7.0~~	~~B~~	~~Mechanical seal drawings~~		~~1S~~	~~4~~			~~1P+1S~~
8.0	B	Auxiliary piping drawing						
9.0	B & C	Inspection and test procedure		1S	4			
10.0	B	Spares list for two years normal operation	1S					
11.0	B	Spares list Mandatory Spares	1S	1S	6			
12.0	B	Coupling drawings		1S	6			4P+1S
13.0	B	Base plate drawing	1S	1S	4			4P+1S
14.0	A	Allowable nozzle forces and moments		1S	6			
15.0	A	Utility consumption list	1S					
16.0	C	Reference list of previous supplies	1S					
17.0	C	Technical literature and catalogues	1S					
18.0	C	Lube data sheet		1S	6			
19.0	C	Packing list						4P+1S
20.0	C	Inspection & test reports and material test certificates		1S	before despatch			4P+1S
21.0	B & C	Installation, operation and maintenance manual (Routine and preventive)						4P+1S
22.0	B	Compliance statement	1S					

Legend :

Group code : A - For review and detailed Engineering , B - For review , C - For information and record

Document type : R - Reproducible , P - Print , S - Soft copy

Notes :

' @ ' Vendor shall fill in proposed lead time if different from the required lead time

' @@ ' Each set of final documents shall be submitted in a folder. Two such folders shall be packed and despatched with the equipment.

REV NO	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED
0	01-02-2021	FOR ENQUIRY	LA	SK	AAN

FACT ENGINEERING AND DESIGN ORGANISATION FEDO

01FT010B / 94-R1

TECHNICAL PROCUREMENT SPECIFICATION	VENDOR DATA REQUIREMENTS	32644-02-PS-002 VDR ELEC	
		Page 1 of 1	R0

PROJECT: Construction of Phosphoric Acid storage tank at Q10 W. Island

ITEM: MEDIUM VOLTAGE INDUCTION MOTORS FOR PUMPS

CLIENT : FACT-CD

TPS. NO: 32644-02-PS-002

STATUS : ■ ENQUIRY **COMMITMENT** **P.O. NO.:**

Sl. No.	Grp. code	Description	Offer	After commitment				@@ Final
			Qty.	Qty.	Lead time in weeks			Qty.
					Reqd.	@ Propd	Agrd.	
1.0	**A**	Duly filled in **Technical particulars of Medium Voltage induction motor** as per proforma enclosed	1S+1P	1S+1P	4			4P+1S
2.0	**A**	Dimensional GA. Drawings, separately for motors and terminal boxes		1S+1P	4			**4P+1S**
3.0	**A**	Foundation drawings / Mounting details		1S+1P	4			**4P+1S**
4.0		Performance characteristic curves		1S+1P				**4P+1S**
4.1	**B**	Speed v/s torque		1S+1P	4			**4P+1S**
4.2	**B**	Speed v/s current		1S+1P	4			**4P+1S**
4.3	**B**	Speed v/s time		1S+1P	4			**4P+1S**
4.4	**B**	Thermal withstand curves under hot & cold conditions (at 100% & 80% rated voltage)		1S+1P	4			**4P+1S**
5.0	**C**	Type test certificates for similar Motors		1S+1P				**4P+1S**
6.0	**C**	Routine test certificates		1S+1P	4			**4P+1S**
7.0	**C**	CMRI certificate / certification from statutory authority of the country of origin, For hazardous area applications						
8.0	**C**	Installation, operation and maintenance Manuel						**4P+1S**
9.0	**B**	Spare parts list						
10.0	**B**	Duly filled and signed **Compliance statement** stating item wise deviation from specs, if any						

Legend:	Group code: A - For review and detailed Engineering, B - For review, C - For information and record Document type: R - Reproducible, P - Print, S – Soft-pendrive/CD
Notes: @ @@	Vendor shall fill in proposed lead time if different from the required lead time. Each set of final documents shall be submitted in a folder. Two such folders shall be packed and despatched with the equipment. Final documents shall be submitted in soft copy also.

REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED
0	12-02-'21	Original Issue	LN	SM	IK

FACT ENGINEERING AND DESIGN ORGANISATION

FEDO

TECHNICAL PROCUREMENT SPECIFICATION	SCOPE OF INSPECTION AND TESTS (Phosphoric Acid Pump)	32644-02-PS-002 INS
		PAGE 1 OF 1

TPS NO.	32644-02-PS-002
ITEM :	**CENTRIFUGAL PUMPS**
EQPT. NO.	P-3202A/B, P-3203A/B, P-3204

The following inspection and test shall be conducted and records submitted.

Sl No.	Description	Inspn. Reqd.	Witness Reqd.	Remarks
1.0	Casing Inspection	X		
1.1	Non-destructive examination			
	Magnetic particle or liquid penetrant on cast casing	X		
	Magnetic particle or liquid penetrant on repair welds	X		
	Magnetic particle or liquid penetrant on weld joints, if any	X		
	Spot radiograph on weld joints			
	Magnetic particle on forged casing			
1.2	Hydrostatic test	X	X	
1.3	Air leak test			
2.0	Rotor inspection	X	X	
2.1	Non-destructive examination			
	Ultrasonic or forging	X		
	Magnetic particle or liquid penetrant on shaft	X		
2.2	Runout test			
2.3	Dynamic balance test	X		
3.0	Performance test with job motor	X	X	
4.0	NPSH test	X	X	
5.0	Mechanical running test	X	X	
	Sound level test	X	X	
6.0	Dismantling inspection	X	X	
	Bearing check			Not Applicable
7.0	Clearance check	X	X	
8.0	Appearance and dimensional inspection	X	X	
9.0	Material test and chemical analysis	X		
10.0	Auxiliary Equipment			
	Hydrostatic test			
	Appearance and dimensional inspection			

0	1702-2021	FOR ENQUIRY	LA	SK	AAN
REV.NO.	**DATE**	**DESCRIPTION**	**PREPARED**	**CHECKED**	**APPROVED**

FACT ENGINEERING AND DESIGN ORGANISATION FEDO

01FT010A/94-R1

TPS NO. 32644-02-PS-002

ITEM : MEDIUM VOLTAGE INDUCTION MOTORS

EQPT. NOS.: P-3202 A/B, P-3203 A/B, P-3204

The following inspection and test shall be conducted and records submitted

Sl. No.	Description	Ins./test Reqd.	Witness Reqd.	Remarks
1.0	Physical verification for conformity with P.O. specifications and approved drawings	Reqd		
2.0	**Routine test** (as per IS), including the following:			
2.1	Insulation resistance test	Reqd		
2.2	High voltage test	Reqd		
2.3	No load running test	Reqd		
2.4	Locked rotor test	Reqd		
2.5	Reduced voltage running test at no load	Reqd		
2.6	Open circuit voltage ratio test	-		
2.7	Testing of accessories / auxiliaries for correct functioning	Reqd		
	Type test certificates shall be furnished.			

0	12-02-'21	Original Issue	LN	SM	IK
REV.	**DATE**	**DESCRIPTION**	**PREPARED**	**CHECKED**	**APPROVED**

FACT ENGINEERING AND DESIGN ORGANISATION FEDO

13FT910D/14

TECHNICAL PROCUREMENT SPECIFICATION	VENDOR DATA INDEX	32644-02-PS-002 VDI	
		PAGE 1 OF 1	R 0

PROJECT: CONSTRUCTION OF PHOSPHORIC ACID STORAGE TANKS AND ASSOCIATED FACILITIES AT Q10 BERTH, WI (2 NO'S)	**PROJECT NO. :** 32644	**VENDOR:**
ITEM: P-3202A/B, P-3203A/B, P-3204	**P.O NO.:**	**DATE:**

Sl. No.	Doc. / Drawing No.	Description	Rev. 0 Date	Rev. 1 Date	Rev. 2 Date	Rev. 3 Date	Rev. 4 Date	Rev. 5 Date	Relevant to This issue

ISSUE NO.													
DATE													
SIGNATURE													

FACT ENGINEERING AND DESIGN ORGANISATION

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00FT020/94

TECHNICAL PROCUREMENT SPECIFICATION	SPARES (MANDATORY)	32644-02-PS-002 SPR(M)
		PAGE 1 OF 1

CENTRIFUGAL PUMPS

Sl No	Description	Quantity (%)	Unit Price	Total Price
1	Impeller	100		
2	Impeller nut	100		
3	~~Mechanical seal (complete assembly)~~	~~100~~		
4	~~Seal parts / kit (seal faces, secondary seal, gaskets, springs and pins)~~	~~100~~		
5	Gland Packing	200		
6	Coupling spares (Flexible elements , bushes, pins, packings, etc	100		
7	Shaft sleeve	100		
8	Impeller wear ring	100		
9	Casing wear ring	100		
10	Bearings			
	Pump	100		
	Motor	100		
11	Oil Seal	100		
12	Oiler	100		
13	Coupling complete	100		

Note:

1. Spares list shall be furnished separately for each pump.
2. Wherever suggested Quantity is less than 100%, minimum 1 set or 1 No: shall be provided
3 Mandatory spares shall be considered for **ONE** pump if more than one pump in a tag.

REV NO	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED
0	17-02-2021	FOR ENQUIRY	LA	SK	AAN

TECHNICAL PROCUREMENT SPECIFICATION	SPARES (2 Years Operational Spares)	32644-02-PS-002 SPR(OP)
		PAGE 1 OF 1

CENTRIFUGAL PUMPS

Sl No	Description	Suggested Quantity (%)	Quantity	Unit Price	Total Price
1	Impeller	VTA			
2	Impeller nut	VTA			
3	~~Mechanical seal (complete assembly)~~	~~VTA~~			
4	~~Seal parts / kit (seal faces, secondary seal, gaskets, springs and pins)~~	~~VTA~~			
5	Coupling spares (Flexible elements , bushes, pins, packings, etc	VTA			
6	Gland packing	VTA			
7	Shaft sleeve	VTA			
8	Impeller wear ring	VTA			
9	Casing wear ring	VTA			
10	Throat bush	VTA			
11	Description	VTA			
12	Bearings	VTA			
	Pump	VTA			
	Motor	VTA			
13	Oil Seal	VTA			
14	Oiler	VTA			
15	Shaft with keys	VTA			
16	Coupling complete	VTA			
17	Gland packing	VTA			

Notes:

1. Spares list shall be furnished separately for each pump.
2. Wherever suggested Quantity is less than 100%, minimum 1 set or 1 No: shall be provided.
3. Purchaser reserves full right to purchase or not to purchase the 2 yrs operational spares fully or partially as per rate quoted by the successful bidder. Quoted rate shall remain firm for 2 yrs from the date of expiry of warrantee period.
4. Price quoted for 2yrs of operational spares shall not be considered for price bid evaluation.

* VTA- Vendor to advice

REV NO.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED
0	17-02-2021	FOR ENQUIRY	LA	SK	AAN

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TECHNICAL PROCUREMENT SPECIFICATION	SPARES (Commissioning Spares)	32644-02-PS-002 SPR(CO)
		PAGE 1 OF 1

HORIZONTAL CENTRIFUGAL PUMPS

Sl No	Description	Suggested Quantity (%)	Quantity	Unit Price	Total Price
1	Impeller	VTA			
2	Impeller nut	VTA			
~~3~~	~~Mechanical seal (complete assembly)~~	~~VTA~~			
4	~~Seal parts / kit (seal faces, secondary seal, gaskets, springs and pins)~~	~~VTA~~			
5	Coupling spares (Flexible elements , bushes, pins, packings, etc	VTA			
6	Gland packing	VTA			
7	Shaft sleeve	VTA			
8	Impeller wear ring	VTA			
9	Casing wear ring	VTA			
10	Throat bush	VTA			
11	Description	VTA			
12	Bearings	VTA			
	Pump	VTA			
	Motor	VTA			
13	Oil Seal	VTA			
14	Oiler	VTA			
15	Shaft with keys	VTA			
16	Coupling complete	VTA			
17	Gland Packing	VTA			

Notes:

1. Spares list shall be furnished separately for each pump.
2. Wherever suggested Quantity is less than 100%, minimum 1 set or 1 No: shall be provided
3. In addition to the vendor listed commissioning spares, vendor binds to provide any additional spare parts required for start-up and commissioning and shall be included in his scope of work without any extra cost to purchaser.
4. Price quoted for commissioning spares shall be considered for price bid evaluation

* VTA- Vendor to advice

REV No.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED
0	17-02-2021	FOR ENQUIRY	LA	SK	AAN

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TECHNICAL PROCUREMENT SPECIFICATION	EQUIPMENT LUBRICATION DATA	32644-02-PS-002 LD
		PAGE 1 OF 1

PROJECT	: CONSTRUCTION OF PHOSPHORIC ACID STORAGE TANKS AND ASSOCIATED FACILITIES AT Q10 BERTH, WI.			
PROJECT NO	: 32644	LOCATION	: Willington Island, Kochi	
TPS NO	: 32644-02-PS-002	VENDOR	:	
CLIENT	: FACT CD			

SL NO	DESCRIPTION	ITEM NO	
1	Type of Lubrication System (State Grease-Gun, Grease Packed, Drip, Splash, Continuous)		
2	Recommended Lubrication for Break in (list two Indian alternatives by trade name and number)		
3	Quantity of Lubricant required for initial fill (Litres or Kg)		
4	Recommended Break - in period for Initial application (Hours)		
5	Recommended Lubrication for normal operation (List two Indian alternatives by trade name and number)		
6	Refill quantities if different from initial charge (Litres or Kg)		
7	Quantity of Lubricant shipped with initial order (Litres or Kg)		
8	Recommended time between changes of Lubricant (Hours)		
9	Expected annual consumption of Lubricant (Litres or Kg)		

Remarks :

REV NO	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED

FACT ENGINEERING AND DESIGN ORGANISATION

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PROCUREMENT SPECIFICATION	COMPLIANCE STATEMENT	32644-02-PS-002 CS
		PAGE 1 OF 1 R 0

TPS NO. 32644-02-PS-002

We state that our Quotation No. ..... is in full compliance with the documents issued against the Enquiry No. .....except for the deviations listed below.

LIST OF DEVIATIONS

Sl. No.	Description	Reasons for Deviation

Name of vendor:

Date Name and designation Seal & signature

PROCESS DATA SHEET	PUMP	32644-11-SE-P3202A/B
		PAGE 1 OF 1 R2

Equipment No.		P-3202A/B				
Equipment Name		Phosphoric Acid Transfer Pumps				
No. Of		1 Working		1 Standby &		0 Warehouse Standby
Type of Equipment		■ Centrifugal	☐ Reciprocating		☐ …….	
Operating Conditions						
Fluid Handled		Phosphoric acid				
Analysis		54% P_2O_5, 2-4%H_2SO_4, 1-2% Gypsum solids.				
Pumping Temperature, ^oC		40^0C				
Density &Viscosity at Pumping Temperature		1630 to 1700kg/m^3 , 65 cP				
Vapor Pressure at P.T & pH value		Negligible				
Operating Level	**Units**	**Min**	**/**	**Normal**	**/**	**Maximum**
Capacity	m^3/h		/	175	/	175
Suction Pressure	kg/cm^2G	0.07	/	0.07	/	
Suction Temperature	^oC	40	/	40	/	40
Discharge Pressure	kg/cm^2G		/	4.0	/	4.0
Differential Pressure	kg/cm^2		/	3.93	/	3.93
Priming						
Net Positive Suction Head		MLC Available:6.46[1]		MLC Required (From Mfr.) …….		
Duty		■ Continuous /	☐ Intermittent			
Drive		■ Electric Motor	☐ Turbine Using …….	☐ …….		
Capacity Control		☐ Local /	■ Remote /	■ Auto		
Location		☐ Indoor /	■ Outdoor			
Area		☐ Hazardous /	■ Non Hazardous			
Necessity to start against system pressure		☐ Yes	■ No			
Material of Construction						
Casing / Cylinders		CD4MCu				
Impeller / Pistons		CD4MCu				
Shaft		CD4MCu				

Drive Turbine Steam Details	**Normal**	**Minimum**	**Maximum**
Inlet / Outlet Pressure, kg/cm^2G	/	/	/
Inlet / Outlet Temperature, ^oC	/	/	/
Packing/Mechanical Seal	Packing. 2		
Flashing Arrangements (From Mfr)	☐ Self Flushing	☐ As per API Plan No. ……	
	☐ Using …… at …… kg/cm^2G & …..^oC		
Minimum Flow Requirements, m^3/h (From Mfr.)			
Shut-off Head (From Mfr.)			

Remarks:

1. NPSH indicated is minimum considering Tank Pad Elevation as 1.15m,LLLL as 1.1m& Pump suction nozzle CL elevation as 1 m.

Rev	Details	By	Chkd.	Apprd.	Date
2	Issued for Engineering	BV	MR	KVR	17.02.2021
1	Issued for comments	BV	MR	KVR	19.06.2020
0	Issued for Comments	BV	MR	KVR	10.06.2020

Project: Construction of Additional Phosphoric Acid Storage Tanks at Q-10 Berth, WI

Client: M/s. FACT-CD

FACT ENGINEERING AND DESIGN ORGANISATION FEDO

PROCESS DATA SHEET	PUMP	32644-11-SE-P3203A/B
		PAGE 1 OF 1 | R2

Equipment No.		P-3203A/B				
Equipment Name		Phosphoric Acid Sump Pump				
No. Of		1 Working		1Standby &		0 Warehouse Standby
Type of Equipment		■ Centrifugal	☐ Reciprocating		☐ …….	
Operating Conditions						
Fluid Handled		Phosphoric acid				
Analysis		54% P_2O_5, 2-4%H_2SO_4, 1-2% Gypsum solids.				
Pumping Temperature, ^oC		40^{0}C				
Density &Viscosity at Pumping Temperature		1630 to 1700kg/m^3 , 65 cP				
Vapor Pressure at P.T & pH value		Negligible				
Operating Level	**Units**	**Min**	**/**	**Normal**	**/**	**Maximum**
Capacity	m^3/h		/	25	/	25
Suction Pressure	kg/cm^{2}G	0.02	/		/	
Suction Temperature	^oC	40	/	40	/	40
Discharge Pressure	kg/cm^{2}G		/	4.4	/	4.4
Differential Pressure	kg/cm^2		/		/	4.38
Priming						
Net Positive Suction Head		MLC Available:6.18[1]		MLC Required (From Mfr.) …….		
Duty		■ Continuous /	☐ Intermittent			
Drive		■ Electric Motor	☐ Turbine Using …….	☐ …….		
Capacity Control		☐ Local /	■ Remote /	■ Auto		
Location		☐ Indoor /	■ Outdoor			
Area		☐ Hazardous /	■ Non Hazardous			
Necessity to start against system pressure		☐ Yes	■ No			
Material of Construction						
Casing / Cylinders		CD4MCu				
Impeller / Pistons		CD4MCu				
Shaft		CD4MCu				

Drive Turbine Steam Details	**Normal**	**Minimum**	**Maximum**
Inlet / Outlet Pressure, kg/cm^{2}G	/	/	/
Inlet / Outlet Temperature, ^oC	/	/	/
Packing/Mechanical Seal	Packing 2		
Flashing Arrangements (From Mfr)	☐ Self Flushing	☐ As per API Plan No. ……	
	☐ Using …… at …… kg/cm^{2}G & …..^{o}C		
Minimum Flow Requirements, m^3/h (From Mfr.)			
Shut-off Head (From Mfr.)			

Remarks:

1. NPSH indicated considering minimum submergence level as 100 mm

Rev	Details	By	Chkd.	Apprd.	Date
2	Issued for Engineering	BV	MR	KVR	**17.02.2021**
1	Issued for Comments	BV	MR	KVR	01.07.2020
0	Issued for Comments	BV	MR	KVR	19.06.2020

Project: Construction of Additional Phosphoric Acid Storage Tanks at Q-10 Berth, WI.

Client: M/s. FACT-CD

FACT ENGINEERING AND DESIGN ORGANISATION FEDO

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PROCESS DATA SHEET	PUMP	32644-11-SE-P3204	
		PAGE 1 OF 1	R1

Equipment No.		P-3204				
Equipment Name		Rain Water Pit Pump				
No. Of		1 Working		0Standby &		0 Warehouse Standby
Type of Equipment		■ Centrifugal		☐ Reciprocating		☐ …….
Operating Conditions						
Fluid Handled		Water				
Analysis		Water				
Pumping Temperature, ^{o}C		$40^{0}C$				
Density &Viscosity at Pumping Temperature		1000 Kg/m^3				
Vapor Pressure at P.T & pH value		0.074Kg/cm^2				
Operating Level	**Units**	**Min**	**/**	**Normal**	**/**	**Maximum**
Capacity	m^3/h		/	25	/	25
Suction Pressure	kg/cm^2G	-0.308	/		/	
Suction Temperature	^{o}C	40	/	40	/	40
Discharge Pressure	kg/cm^2G		/	1	/	1
Differential Pressure	kg/cm^2		/		/	1.308
Priming						
Net Positive Suction Head		MLC Available:6.50		MLC Required (From Mfr.) …….		
Duty		☐ Continuous /		■ Intermittent		
Drive		■ Electric Motor		☐ Turbine Using …….		☐ …….
Capacity Control		■ Local /		☐ Remote /		☐ Auto
Location		☐ Indoor /		■ Outdoor		
Area		☐ Hazardous /		■ Non Hazardous		
Necessity to start against system pressure		☐ Yes		■ No		
Material of Construction						
Casing / Cylinders		CD4MCu				
Impeller / Pistons		CD4MCu				
Shaft		CD4MCu				

Drive Turbine Steam Details	**Normal**	**Minimum**	**Maximum**
Inlet / Outlet Pressure, kg/cm^2G	/	/	/
Inlet / Outlet Temperature, ^{o}C	/	/	/

Packing/Mechanical Seal	Packing
Flashing Arrangements (From Mfr)	☐ Self Flushing ☐ As per API Plan No. ……
	☐ Using …… at …… kg/cm^2G & …..^{o}C
Minimum Flow Requirements, m^3/h (From Mfr.)	
Shut-off Head (From Mfr.)	

Remarks:

1. Maximum elevation for discharge head is assumed as 5 meters.

Rev	Details	By	Chkd.	Apprd.	Date
1	Issued for Engineering	BV	MR	KVR	**17.02.2021**
0	Issued for Comments	BV	MR	KVR	01.07.2020

Project: Construction of Additional Phosphoric Acid Storage Tanks at Q-10 Berth, WI.

Client: M/s. FACT-CD

FACT ENGINEERING AND DESIGN ORGANISATION FEDO

11FT028/15

DATA SHEET	CENTRIFUGAL PUMP	32644-01-DA-004 (Mech)
		PAGE 1 OF 3

Job N o	: **32644**	**TPS No**	: **32644-02-PS-002**
Applicable to : ☐ Proposal ☒ Purchase ☐ As built		No of electric motors reqd	: 2
Site	: Q10 BERTH, WI, FACT CD	Motor item No.	:
Unit	: PHOSPHORIC ACID STORAGE TANK	Motor provided by	: Pump vendor
Pump item No.	: P3202A/B	Motor mounted by	: Pump vendor
Service	: Phosphoric Acid Transfer Pump	No. of turbines reqd	:
No. of pumps reqd	: 2	Turbine item No.	:
Pump mfr.	:	Turbine provided by	:
Pump size & type	: Horizontal Centrifugal	Turbine mounted by	:
Pump model No.	:	Remarks : Service specification:-	
No. of stages	: SINGLE	54% P2O5, 2-4%H2SO4, 1-2% Gypsum solids.	

Notes :
1 Information to be completed : ☐ By Purchaser ☐ By Manufacturer
2 Units of measurement ☐ SI System ☒ Metric System
3 VTS- Vendor to specify 4 VTC- Vendor to Confirm. 5 VTA Vendor to advice

OPERATING CONDITIONS (TO BE COMPLETED BY PURCHASER)

Liquid	: Phosphoric Acid			NPSH available (NPSHA)	: 6.46	MLC	
Pumping temperature	Normal	: 40	^0C	pH Value	:		
	Minimum	: 40	^0C	Capacity @ PT	Minimum	:	$M^3/Hr.$
	Maximum	:	^0C		Normal	: 175	$M^3/Hr.$
Sp. gravity @ PT	: 1.63 - 1.7				Maximum	: 175	$M^3/Hr.$
Vapor press. @ PT	: Negligible	Kg/cm^2_A		Discharge pressure	: 4.0	Kg/cm^2_G	
Viscosity @ PT	: 65	$_CP$		Suct. pressure	Maximum	:	Kg/cm^2_G
Site temperature	Maximum	:	^0C		Minimum	: 0.07	Kg/cm^2_G
	Ambient		^0C		Normal	: 0.07	Kg/cm^2_G
	Minimum	:	^0C	Differential pressure	: 3.93	Kg/cm^2	
Un usual conditions	:			Differential head	:	MLC	
Corrosion/erosion caused by	:			Hydraulic KW	:		
Duty	☒ Continuous ☐ Intermittent			Location	☐ Indoor ☐ Heated ☐ With roof		
Remarks :	Capacity Control: Remote and Auto				☒ Outdoor ☐ Unheated ☒ Without roof		

PERFORMANCE (TO BE COMPLETED BY MANUFACTURER)

Proposal curve No.	:		Minimum continuous flow	Thermal :	M^3/Hr
Speed	:	RPM		Stable :	M^3/Hr
NPSH reqd. (NPSHR) *note 1	:	MLC	Rotation (Viewed from coupling end)	☐ CW ☐ CCW	
Rated BHP	:	KW			
Max. BHP with rated impeller	:	KW	Suction sp. Speed	:	
Max. head with rated impeller	:	M	Efficiency (VTS)	:	%

Remarks : Necessity to start against system pressure: NO

CONSTRUCTION (TO BE COMPLETED BY PURCHASER & MANUFACTURER)

Casing mount	☐ Centerline	☐ Near centerline		Nozzles	Size	Rating	Facing	Location
	☒ Foot	☐ Vertical	☐ In line	Suction			F.F	
(VTS)	☐ Bracket	☐ Vert. barrel	☐ Sump pump	Discharge			F.F	
Casing split (VTS)	☐ Axial	☐ Radial		Miscellaneous connections				
Casing type (VTS)	☐ Volute	☐ Single	☐ Staggered	Nozzles	Drain	Vent	Pressure gauge	
	☐ Diffuser	☐ Double		Suction	X			
Pressure Balancing:				Discharge		X		

Note 1 : VTS (Margin between NPSHA and NPSHR should be minimum 0.6 meters.)
2 : MLC- Meters of Liquid column
3 : Also refer to Process data sheet 32644-11-SE-P3202A/B and P&ID 32644-11-PD-001.
4 : Pump Design Standard : BS/IS

					PROJECT	CONSTRUCTION OF PHOSPHORIC ACID STORAGE TANKS AND ASSOCIATED FACILITIES AT Q10 BERTH, WI.
					CLIENT	
0	17-02-2021	LA	SK	AAN	P.O No.	
REV	**DATE**	**PRPD.**	**CHKD.**	**APPRD.**	VENDOR	

FACT ENGINEERING AND DESIGN ORGANISATION FEDO

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DATA SHEET	CENTRIFUGAL PUMP	32644-01-DA-004 (Mech)
		PAGE 2 OF 3 R0

☐ Maximum allowable pr.	Kg/cm^2_G@15^{0}C Kg/cm^2_G@PT	Bearings Type / No.	☐ Radial ☐ Thrust
☐ Hydro static test pr.	Kg/cm^2_G	Lubrication Type	☐ Ring oil ☐ Oil mist ☐ ☐ Flood ☐ Pressure ☐ Flinger
Impeller dia. (mm)	☐ Rated ☐ Maximum ☐ Minimum	Coupling	☐ Manufacturer ☐ Type Flexible disc spacer ☐ Model
Impeller mount	☐ Between bearings ☐ Overhung	Driver half Coupling Manufact-ured by	☒ Pump manufacturer ☒ Driver manufacturer ☐ Purchaser
Impeller type	☐ Closed ☐ Semi-open ☒ Open		
Packing: Gland Packing	Manufacturer Type: Gland Packing Size/No.of rings	Gland plate taps reqd.	☐ Quench ☐ Flush ☐ Drain ☐ Vent
Mechanical seal (Not Required)	☐ Single ☐ Double ☐ Tandem ☐ Manufacturer ☐ Model ☐ Manufacturer code ☐ API class code ☐ Gland type / Material	Remarks :	

~~Compatibility of Mechanical seal with respect to Seal Flush/Quench plan (VTC)~~

AUXILARY PIPING (TO BE COMPLETED BY PURCHASER & MANUFACTURER)

☐ Seal flush piping plan ☐ Tubing ☐ Carbon steel ☐ Piping ☐ Stainless steel	☐ Cooling water piping plan : ☐ Tubing ☐ Carbon steel ☐ Copper ☐ Piping ☐ Stainless steel
Auxiliary flush plan ☐ Tubing ☐ Carbon steel ☐ Aux.flush liquid ☐ Piping ☐ Stainless steel	☐ Total cooling water reqd. : M^3/Hr. ☐ Sight flow indicators reqd. :
☐ Seal flush pipng : ☐ Threaded ☐ Socket welded ☐ Flanged	☐ Packing cooling injection reqd. : ☐ M^3/Hr. ☐ Kg/cm^2_G Remarks :
☐ External seal flush fluid reqd. : ☐ M^3/Hr. ☐ Kg/cm^2_G	

MOC	☒ Base plate/ Foundation Bolt(material / type) SS 316L
☒ Casing/Cylinder : CD4MCu	Base plate draining arrangement shall be provided to prevent ingress of acid beneath the baseplate
☒ Impeller: CD4MCu	
☒ Case/impeller wear rings: CD4MCu	☐ API std.610 std. base plate No.
☒ Shaft : CD4MCu	Remarks : Other wetted parts : CD4MCu

INSPECTION AND TESTS (TO BE COMPLETED BY PURCHASER) As per scope insp.& tests

Tests	Non witnessed	Witnessed	Observed
Performance	☐	☐	☐
Hydrostatic	☐	☐	☐
NPSH	☐	☐	☐
☐ Shop inspection ☐ Material certification			
☐ Dismantle and inspect after test			
☐ Casting repair procedure approval			
Remarks :			

☐ Inspection required for nozzle welds
☐ Magnetic Particle ☐ Dye penetrant
☐ Inspection required for castings
☐ Radiographic ☐ Ultrasonic
☐ Inspection required for
☐ Magnetic Particle ☐ Dye Penetrant
☐ Radiographic ☐ Ultrasonic

DATA SHEET	CENTRIFUGAL PUMP	32644-01-DA-004 (Mech)
		PAGE 3 OF 3 R0

MOTOR DRIVER (TO BE COMPLETED BY PURCHASER & MANUFACTURER)

☐ KW @ RPM	☐ Manufacturer
☐ Service factor	☐ Type
☐ Frame No.	☐ Bearings
☐ Volts / phase / hertz	☐ Lube
☐ Temperature rise ^0C	☐ Insulation
☐ Full load amps.	☐ Enclosure
☐ Locked - rotor amps.	Remarks:
Vertical shaft ☐ Hollow ☐ Solid	
☐ Vertical thrust capacity, Kg Up Down	

VERTICAL PUMPS (TO BE COMPLETED BY PURCHASER & MANUFACTURER)

(For vertical pumps attach Format No. 01FT010 X)

☐ Pit or sump depth mm		Float & rod	☐ Carbon steel ☐ Stainless steel ☐ Bronze ☐ None
☐ Pump length mm (mount plate to suction flange)			☐ Float switch
☐ Minimum submergence reqd. mm		Pump thrust, Kg	☐ At min. flow ☐ At design flow ☐ At run out ☐ Up ☐ Down
Column pipe	☐ Flanged ☐ Threaded		
Line shaft	☐ Open ☐ Enclosed		
Guide bushings	☐ Bowl ☐ Line shaft		
Guide bushing lube ☐ Water ☐ Oil ☐ Grease ☐		Remarks :	
☐ Lube fluid Quantity M^3/hr Pr Kg/cm^2_G			

WEIGHTS (TO BE COMPLETED BY PURCHASER & MANUFACTURER)

Weight of pump & base plate	Kg	Remarks:
Weight of motor	Kg	
Weight of turbine	Kg	

PACKING AND SHIPPING

Packing type	☐ Domestic	☐ Export
Packing specs.	☐ Mfr's standard	☐ Purchaser's specs.
Packed weight	Kg	
Packing size	(LXBXH) mm	
Shipping by	☐ Rail ☐ Road	☐ Ocean ☐

Notes:

1) Pump shall be capable of running dry for few minutes.
2) Equipment shall be designed to be suitable for outdoor installation without a roof.
3) Bearing must have greasing provision
4) The scope of supply include the following items.
   a) Pumps, b) Drive Motors, c) Gland Packing ~~Mechanical seal~~, d) ~~Minimum flow recirculation valve~~ e) Couplings,
   f) Coupling Guards,g)Base Plate, h) Anchor Bolts with nuts, i) Piping confined to battery limit, j) Mating flanges for suction - and dischargenozzles k) Mandatory spares, l) Commissioning spares - VTS, m) First-fill of lubricants - VTS.
5) Flange Rating : Flange rating for pump shall have a minimum requirement, confirm to the dimentional requirement of ISO 7005-1 PN 50 and Equivalent to ANSI/ASME B 16.5 class 150#
6) MAWP: It should be at least the max discharge pressure + 10% of the max differential pressure.
7) Downstream design Pressure is 1.5 Times of Max operating pressure. Maximum Shutoff considering max suction pressure, including all tolerances shall not exceed this value.
8) Corrossion allowance for MOC other than CD4MCu: 3 mm

DATA SHEET	CENTRIFUGAL PUMP	32644-01-DA 005 (Mech)
		PAGE 1 OF 4

Job No	: **32644**	**TPS No**	: **32644-02-PS-002**
Applicable to : ■ Proposal ☐ Purchase ☐ As-built		No of electric motors reqd	: 2
Site	: Q10 BERTH, WI, FACT CD	Motor item No.	: *
Unit	: PHOSPHORIC ACID STORAGE TANK	Motor provided by	: Vendor
Pump item No.	: P 3203A/B	Motor mounted by	:
Service	: Phosphoric Acid Sump Pump	No. of turbines reqd	: -
No. of pumps reqd	: 2 (1 Working + 1 Stand by)	Turbine item No.	: -
Pump mfr.	: *	Turbine provided by	: -
Pump size & type	: Vertical Centrifugal	Turbine mounted by	: -
Pump model No.	: *	Remarks :	
No. of stages	: *		

Notes :
1 Information to be completed : ☐ By Purchaser ☐ By Manufacturer
2 * Vendor To Specify (VTS) 3. # Vendor To Confirm (VTC) 4. $ Vendor to advise (VTA)
5 Units of measurement ☐ SI System ☒ Metric System

OPERATING CONDITIONS (TO BE COMPLETED BY PURCHASER)

Liquid	: **Phosphoric Acid**			NPSH available (NPSHA)	: 6.18	MLC		
Pumping temperature	Normal	: 40	^{0}C	pH Value	:			
	Minimum	: 40	^{0}C	Capacity @ PT	Normal	: 25	M^3/Hr.	
	Maximum	: 40	^{0}C		Minimum	:	M^3/Hr.	
Density @ PT	: 1630 - 1700	Kg/M^3			Maximum	: 25	M^3/Hr.	
Vapor press. VP@ PT	: Negligible	Kg/cm^2 A		Discharge pressure(Nor/Max)	: 4.4 / 4.4	Kg/cm^2_G		
Dynamic Viscosity (cP) @ PT	: 65	cP		Suct. pressure	Maximum	:	Kg/cm^2_G	
Site temperature	Maximum	:	^{0}C		Minimum	: 0.02	Kg/cm^2_G	
	Ambient	:	^{0}C		Normal	:	Kg/cm^2_G	
	Minimum	:	^{0}C	Differential Pressure (Max)	: 4.38	Kg/cm^2		
Solids in suspension	: 54% P2O5, 2-4%H2SO4,			Suction temperature	: 40	^{0}C		
Un usual conditions	: 1-2% Gypsum solids.			Differential head (VTS)	:	MLC		
Corrosion/erosion caused by	:			Hydraulic KW (VTS)	:			
Duty	☒ Continuous ☐ Intermittent			Location	☐ Indoor ☐ Heated ☐ With roof			
Remarks :	Priming - Flooded suction				☒ Outdoor ☐ Unheated ☒ Without roof			

PERFORMANCE (TO BE COMPLETED BY MANUFACTURER)

Proposal curve No.	:		Minimum continuous flow	Thermal :	M^3/Hr
Speed	:	RPM		Stable :	M^3/Hr
NPSH reqd. (NPSHR) *note 1	:	MLC	Rotation (facing coupling end)	☐ CW ☐ CCW	
Rated BHP	:	KW			
Max. BHP with rated impeller	:	KW	Suction sp. Speed	:	
Max. head with rated impeller	:	M	Efficiency (VTS)	:	%

Remarks :

CONSTRUCTION (TO BE COMPLETED BY PURCHASER & MANUFACTURER)

Casing mount	☐ Centerline ☐ Near centerline		Nozzles	Size*	Rating	Facing	Location
	☐ Foot ☒ Vertical ☐ In line		Suction		ANSI B 16.5, 150#	F.F	
	☐ Bracket ☐ Vert. barrel ☒ Sump pump		Discharge		ANSI B 16.5, 150#	F.F	
Casing split	☐ Axial ☐ Radial		Miscellaneous connections				
Casing type	☒ Volute ☐ Single ☐ Staggered		Nozzles	Drain	Vent	Pressure gauge	
	☐ Diffuser ☐ Double		Suction	☐	☐	☐	
Pressure balancing: Line and disc required			Discharge	☒	☒	☒	
Cooling water Inlet/outlet *			Casing Steam Jacket	Not Required			

Note 1 : If not specified elsewhere, margin between NPSHA and NPSHR shall be minimum 0.6 MLC
2 : MLC - Meters of Liquid Column
3 : NPSH available is indicated considering minimum submergence level as 100 mm.
4 : Also refer to Process data sheet 32644-11-SE-P3203 and P&ID 32644-11-PD-001.
5 : Pump design Standard : BS/IS

					PROJECT	Construction of Additional Phosphoric Acid Storage Tanks at Q10 Berth, WI
					CLIENT	FACT CD
					P.O No.	
0	17.02.2021	LA	SK	AAN	VENDOR	
Rev	DATE	PRPD.	CHKD.	APPRD.		

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☐ Maximum allowable pr.	* Kg/cm^2 G @15^{0}C * Kg/cm^2 G @ PT	Bearings* Type / No.	☐ Radial ☐ Thrust
☐ Hydro static test pr.	* Kg/cm^2 G	Lubrication* Type	☐ Ring oil ☐ Oil mist ☐ ☐ Flood ☐ Pressure ☐ Flinger
Impeller dia (mm)	☐ Rated * ☐ Maximum * ☐ Minimum *	Coupling *	☐ Manufacturer ☐ Type Flexible disc spacer ☐ Model
Impeller mount	☐ Between bearings ☐ Overhung	Driver half coupling to be supplied by	☒ Pump manufacturer
Impeller type*	☐ Closed ☐ Semi-open ☒ Open		☐ Driver manufacturer
Packing: Gland packing	Manufacturer Type Gland Packing Size/No.of rings		☐ Purchaser
		Gland plate taps reqd.	☐ Quench ☐ Flush ☐ Drain ☐ Vent
Mechanical Seal Not Required	☐ Single ☐ Double ☐ Tandem ☐ Manufacturer ☐ Model ☐ Manufacturer code ☐ API class code ☐ Gland type / Material	Remarks :	

~~Compatibility of Mechanical seal with respect to Seal Flush/Quench plan~~ #

AUXILARY PIPING (TO BE COMPLETED BY PURCHASER & MANUFACTURER)

☐ Seal flush piping plan VTA (If required)$	☐ Cooling water piping plan : VTA (If required)$
☐ Tubing ☐ Carbon steel	☐ Tubing ☐ Carbon steel ☐ Copper
☐ Piping ☐ Stainless steel	☐ Piping ☐ Stainless steel
Auxiliary flush plan	☐ Total cooling water reqd. : M^3/Hr.
☐ Tubing ☐ Carbon steel ☐ Aux.flush liquid	☐ Sight flow indicators reqd. :
☐ Piping ☐ Stainless steel	☐ Packing cooling injection reqd. :
☐ Seal flush piping :	☐ ` M^3/Hr. ☐ Kg/cm^2_G
☐ Threaded ☐ Socket welded ☐ Flanged	Remarks :
☐ External seal flush fluid reqd. :	
☐ M^3/Hr. ☐ Kg/cm^2_G	

All interface connection shall be terminated with Flanged Block Valves

	Size/Rating (ANSI)/Facing
Lantern ring Inlet/Outlet	*
Exit Seal Flush inlet/outlet	*
Seal Quench Fluid Inlet	*

☒ **MOC:**	☐ Base plate (material / type)
☒ Casing/Cylinder : CD4MCu	☐ API 610 std. base plate No.
☒ Impeller CD4MCu	☐ Base plate Drain Pan Type
☒ Case/impeller wear rings CD4MCu	Base plate drain (Only flanged)*
☒ Shaft / sleeve CD4MCu	Remarks :

INSPECTION AND TESTS (TO BE COMPLETED BY PURCHASER)

Tests	Non witnessed	Witnessed	Observed		
Performance	☐	☐	☐	☐ Magnetic Particle	☐ Dye penetrant
Hydrostatic	☐	☐	☐	☐ Inspection required for castings	
NPSH	☐	☐	☐	☐ Radiographic	☐ Ultrasonic
☐ Shop inspection	☐ Material certification			☐ Inspection required for	
☐ Dismantle and inspect after test				☐ Magnetic Particle	☐ Dye Penetrant
☐ Casting repair procedure approval				☐ Radiographic	☐ Ultrasonic
Remarks : ***As per scope inspection & tests attched***					

DATA SHEET	CENTRIFUGAL PUMP	32644-01-DA 005 (Mech)
		PAGE 3 OF 4 R0

MOTOR DRIVER (TO BE COMPLETED BY PURCHASER & MANUFACTURER)

☐ * KW @ * RPM	☐ Manufacturer *
☐ Service factor *	☐ Type *
☐ Frame No. *	☐ Bearings *
☐ Volts / phase / hertz *	☐ Lube *
☐ Temperature rise * ^{0}C	☐ Insulation*
☐ Full load amps. *	☐ Enclosure*
☒ ~~Parallel Operation required~~	
☐ Locked - rotor amps.*	Remarks:
Vertical shaft ☐ Hollow ☒ Solid	
☐ Vertical thrust capacity, Kg* Up Down	

VERTICAL PUMPS (TO BE COMPLETED BY PURCHASER & MANUFACTURER)

(For vertical pumps attached Format No. 01FT010 97) - Shall be filled by vendor.

☐ Pit or sump depth As per GA attached mm		Float & rod	☒ Carbon steel ☒ Stainless steel ☒ Bronze ☒ None
☐ Pump length mm (mount plate to suction flange)			☐ Float switch
☐ Minimum submergence reqd. mm		Pump thrust, Kg	☐ At min. flow ☐ At design flow ☐ At run out ☐ Up ☐ Down
Column pipe	☐ Flanged ☐ Threaded		
Line shaft	☐ Open ☐ Enclosed		
Guide bushings	☐ Bowl ☐ Line shaft		
Guide bushing lube ☐ Water ☐ Oil ☐ Grease ☐		Remarks :	
		First dry critical speed of pump in vertical condition(rpm)*	
☐ Lube fluid Quantity M^3/hr Pr Kg/cm^2_G			

WEIGHTS (TO BE COMPLETED BY PURCHASER & MANUFACTURER)

Weight of pump & base plate * Kg	Remarks:	
Weight of motor * Kg		
Weight of coupling * Kg		
Weight of turbine * Kg		

PACKING AND SHIPPING

Packing type*	☐ Domestic	☐ Export		
Packing specs.*	☐ Mfr's standard	☐ Purchaser's specs.		
Packed weight*	Kg			
Packing size*	(LXBXH) mm			
Shipping by*	☐ Rail	☐ Road	☐ Ocean	☐

NOTES:

1. The scope of supply include the following items.
   a) Pumps, b) Drive Motors, c) Gland Packing ~~Mechanical Seals~~, d) ~~Minimum flow recirculation valve~~ e) Couplings, f) Coupling - Guards, g) Mounting flanges with gasket, h) Anchor Bolts with nuts, i) Piping confined to battery limit, j) Mating flanges for suction - and discharge nozzles, k) suction strainer, l) column pipe, m) delivery pipe n) Mandatory spares, o) Commissioning spares - VTS p) First-fill of lubricants - VTS.
2. Area classification: Non Hazardous
3. Non sparking coupling guard to be provided.
4. MAWP: It should be at least the max discharge pressure + 10% of the max differential pressure.
5. Downstream design Pressure is 1.5 Times of Max operating pressure. Maximum Shutoff considering max suction pressure, including all tolerances shall not exceed this value.
6. Process min flow shall be equal to Pump MCF (Minimum Continuous flow)
7. Flange Rating : Flange rating for pump shall have a minimum requirement, confirm to the dimentional requirement of ISO 7005-1 PN 50 and Equivalent to ANSI/ASME B 16.5 class 150#
8. Material of construction for mounting plate shall be minimum IS 2062 Gr. E250C+3mm SS316L cladding. Material of construction for Mounting fasteners shall be SS 316L. The thickness of mounting plate shall be minimum 20mm.

9	This pump is to be installed in sump.
10	Pump manufacturer shall furnish dimensional details as per attachement of this data sheet
11	Shaft shall be solid cantilever. Bearings shall be above mounting plate. No intermediate and bottom bearing.
12	Discharge pressure as indicated is at pump discharge flange, bidder shall arrive/calculate the impeller head after accounting for installation depth, frictional loses etc, so as to generate specified discharge pressure at pump discharge flange.
13	Corrossion allowance for MOC other than CD4MCu: 3 mm
14	Studs / Bolts shall be of CD4MCu for wetted and AISI 316L for non wetted parts.
15	Minimum submergence is to be advised by vendor. Indicate minimum submergence value as per attachement of this data sheet.
16	Mounting plate / flanges along with bolts / nuts & gaskets shall be provided by the vendor.
17	The dimensions for the mounting plate, bolting, gaskets etc. shall be as per the following standards.
	For Sizes ≤ 24 inches: ASME B16.5, For Sizes > 24 inches: ASME B16.47 Series B. Vendor to indicate the mounting plate size.

DATA SHEET	CENTRIFUGAL PUMP	01FT010X/97
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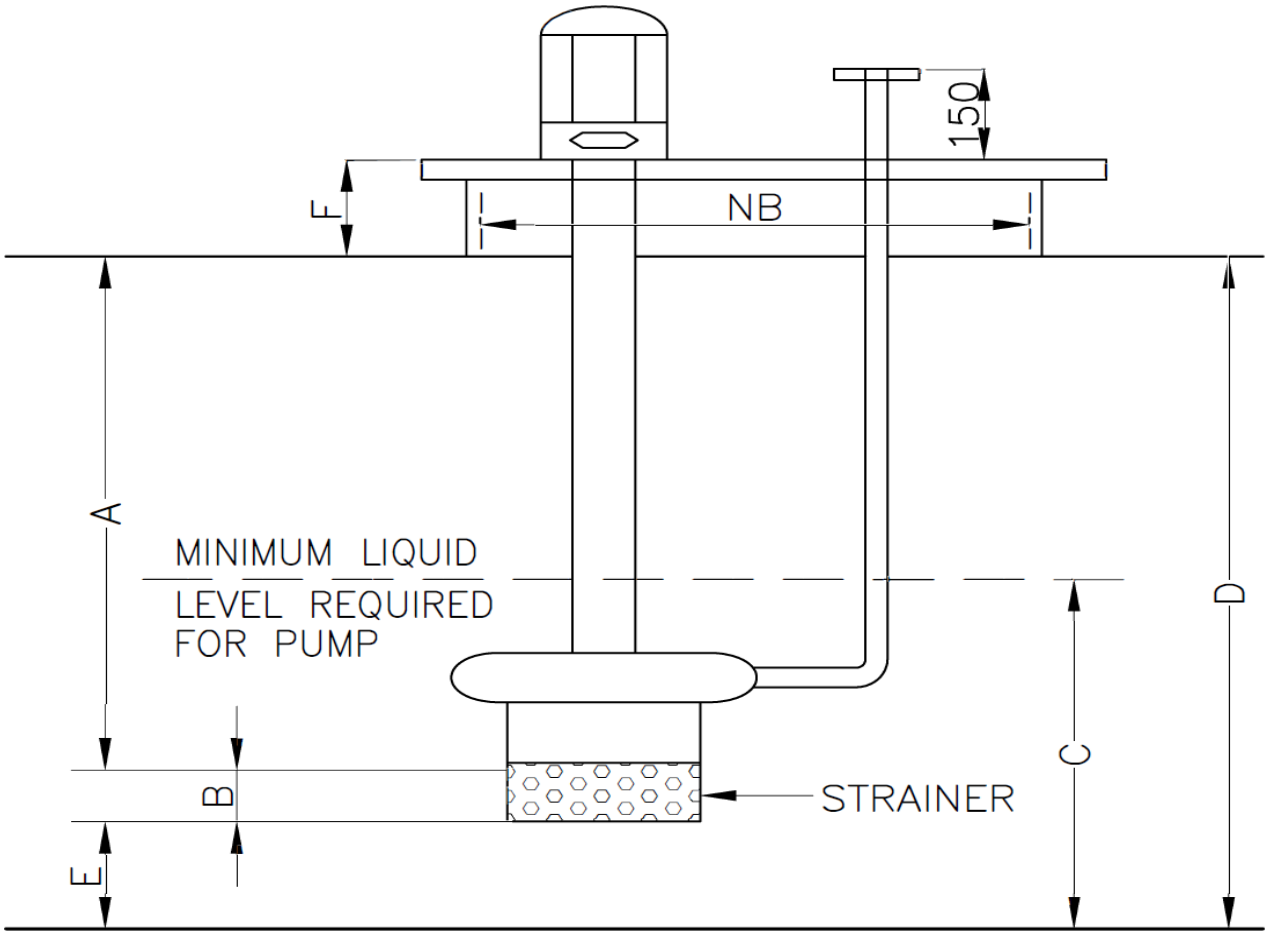

NOTES:

1 ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.

2 SUMP DIMENSION IS 5000x5000x2000 DEPTH.

3 HHLL - 1800

4 HHLL - C = PUMPABLE VOLUME = min. 35M^3

5 VENDOR SHALL INDICATE DIMENSIONS A, B, C, E & NB

ITEM	A	B	C	D	E	F	NB
				2000		100	

						PROJECT: CONSTRUCTION OF PHOSPHORIC ACID STORAGE TANKS AND ASSOCIATED FACILITIES AT Q10 BERTH, WI (2 NO'S)
						TITLE: GA Phosphoric Acid Sump Pump P 3203
Rev	DATE	DESCRIPTION	DRAWN	CHKD	APPD	DWG NO:

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DATA SHEET	CENTRIFUGAL PUMP	32644-01-DA 006 (Mech) PAGE 1 OF 3

Job N o	: **32644**	**TPS No**	: **32644-02-PS-002**
Applicable to : ☐ Proposal ☒ Purchase ☐ As built		No of electric motors reqd	: 1
Site	: Q10 BERTH, WI, FACT CD	Motor item No.	:
Unit	: PHOSPHORIC ACID STORAGE TANK	Motor provided by	: Pump vendor
Pump item No.	: P3204	Motor mounted by	: Pump vendor
Service	: STORM WATER	No. of turbines reqd	:
No. of pumps reqd	: 1	Turbine item No.	:
Pump mfr.	:	Turbine provided by	:
Pump size & type	: Horizontal Centrifugal	Turbine mounted by	:
Pump model No.	:	Remarks :	
No. of stages	: SINGLE		

Notes :
1 Information to be completed : By Purchaser / By Manufacturer
2 Units of measurement : SI System / X Metric System
3 VTS- Vendor to specify 4 VTC- Vendor to Confirm. 5 VTA Vendor to advice

OPERATING CONDITIONS (TO BE COMPLETED BY PURCHASER)

Liquid	: STORM WATER			NPSH available (NPSHA)	: 6.5	MLC	
Pumping temperature	Normal : 40	^{0}C		pH Value	:		
	Minimum :	^{0}C		Capacity @ PT	Normal : 25	M^3/Hr.	
	Maximum :	^{0}C			Minimum :	M^3/Hr.	
Sp. gravity @ PT	: 1				Maximum : 25	M^3/Hr.	
Vapor press. @ PT	: 0.074	Kg/cm^2_A		Discharge pressure	: 1	Kg/cm^2_G	
Viscosity @ PT	:	$_C$P		Suct. pressure	Maximum :	Kg/cm^2_G	
Site temperature	Maximum :	^{0}C			Minimum : -0.308	Kg/cm^2_G	
	Ambient	^{0}C			Normal :	Kg/cm^2_G	
	Minimum :	^{0}C		Differential pressure	: 1.308	Kg/cm^2	
Un usual conditions	:			Differential head	:	MLC	
Corrosion/erosion caused by	:			Hydraulic KW	:		
Duty	X Continuous ☐ Intermittent			Location	☐ Indoor ☐ Heated ☐ With roof		
Remarks :	Capacity Control: Local				X Outdoor ☐ Unheated X Without roof		

PERFORMANCE (TO BE COMPLETED BY MANUFACTURER)

Proposal curve No.	:		Minimum continuous flow	Thermal :	M^3/Hr
Speed	:	RPM		Stable :	M^3/Hr
NPSH reqd. (NPSHR) *note 1	:	MLC	Rotation (Viewed from coupling end)	☐ CW ☐ CCW	
Rated BHP	:	KW			
Max. BHP with rated impeller	:	KW	Suction sp. Speed	:	
Max. head with rated impeller	:	M	Efficiency (VTS)	:	%

Remarks : Necessity to start against system pressure: NO

CONSTRUCTION (TO BE COMPLETED BY PURCHASER & MANUFACTURER)

Casing mount (VTS)	☐ Centerline	☐ Near centerline			
	☒ Foot	☐ Vertical	☐ In line		
	☐ Bracket	☐ Vert. barrel	☐ Sump pump		
Casing split (VTS)	☐ Axial	☐ Radial			
Casing type (VTS)	☐ Volute	☐ Single	☐ Staggered		
	☐ Diffuser	☐ Double			
Pressure Balancing:					

Nozzles	Size	Rating	Facing	Location
Suction			F.F	
Discharge			F.F	

Miscellaneous connections

Nozzles	Drain	Vent	Pressure gauge
Suction	X		
Discharge		X	

Note 1 : VTS (Margin between NPSHA and NPSHR should be minimum 0.6 meters.)
2 : MLC- Meters of Liquid column
3 : Also refer to Process data sheet 32644-11-SE-P3204 and P&ID 32644-11-PD-002.
4 : Pump Design standard- BS/IS

					PROJECT	CONSTRUCTION OF PHOSPHORIC ACID STORAGE TANKS AND ASSOCIATED FACILITIES AT Q10 BERTH, WI.
					CLIENT	
0	17-02-2021	LA	SK	AAN	P.O No.	
REV.	DATE	PRPD.	CHKD.	APPRD.	VENDOR	

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DATA SHEET	CENTRIFUGAL PUMP	32644-01-DA 006 (Mech)
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☐ Maximum allowable pr.	Kg/cm^2_G@15^{0}C Kg/cm^2_G@PT	Bearings Type / No.	☐ Radial ☐ Thrust
☐ Hydro static test pr.	Kg/cm^2_G	Lubrication Type	☐ Ring oil ☐ Oil mist ☐ ☐ Flood ☐ Pressure ☐ Flinger
Impeller dia. (mm)	☐ Rated ☐ Maximum ☐ Minimum	Coupling	☐ Manufacturer ☐ Type Flexible disc spacer ☐ Model
Impeller mount	☐ Between bearings ☐ Overhung	Driver half Coupling Manufact-ured by	☒ Pump manufacturer
Impeller type	☐ Closed ☐ Semi-open ☒ Open		☒ Driver manufacturer
Packing: Gland packing	Manufacturer Type Gland Packing Size/No.of rings		☐ Purchaser
		Gland plate taps reqd.	☐ Quench ☐ Flush ☐ Drain ☐ Vent
Mechanical seal (Not Required)	☐ Single ☐ Double ☐ Tandem ☐ Manufacturer ☐ Model ☐ Manufacturer code ☐ API class code ☐ Gland type / Material	Remarks :	

AUXILARY PIPING (TO BE COMPLETED BY PURCHASER & MANUFACTURER)

☐ Seal flush piping plan ☐ Tubing ☐ Carbon steel ☐ Piping ☐ Stainless steel	☐ Cooling water piping plan : ☐ Tubing ☐ Carbon steel ☐ Copper ☐ Piping ☐ Stainless steel
Auxiliary flush plan ☐ Tubing ☐ Carbon steel ☐ Aux.flush liquid ☐ Piping ☐ Stainless steel	☐ Total cooling water reqd. : $M^3/Hr.$ ☐ Sight flow indicators reqd. :
☐ Seal flush pipng : ☐ Threaded ☐ Socket welded ☐ Flanged	☐ Packing cooling injection reqd. : ☐ $M^3/Hr.$ ☐ Kg/cm^2_G Remarks :
☐ External seal flush fluid reqd. : ☐ $M^3/Hr.$ ☐ Kg/cm^2_G	
MOC	☒ Base plate/ Foundation Bolt(material / type) SS 316L
☒ Casing/Cylinder : CD4MCu ☒ Impeller: CD4MCu	Base plate draining arrangement shall be provided to prevent ingress of acid beneath the baseplate
☒ Case/impeller wear rings: CD4MCu	☐ API std.610 std. base plate No.
☒ Shaft : CD4MCu	Remarks : Other wetted parts : CD4MCu

INSPECTION AND TESTS (TO BE COMPLETED BY PURCHASER) As per scope insp.& tests

Tests	Non witnessed	Witnessed	Observed
Performance	☐	☐	☐
Hydrostatic	☐	☐	☐
NPSH	☐	☐	☐

☐ Inspection required for nozzle welds	
☐ Magnetic Particle	☐ Dye penetrant
☐ Inspection required for castings	
☐ Radiographic	☐ Ultrasonic
☐ Shop inspection ☐ Material certification	☐ Inspection required for
☐ Dismantle and inspect after test	☐ Magnetic Particle ☐ Dye Penetrant
☐ Casting repair procedure approval	☐ Radiographic ☐ Ultrasonic
Remarks :	

DATA SHEET	CENTRIFUGAL PUMP	32644-01-DA 006 (Mech)
		PAGE 3 OF 3 R0

MOTOR DRIVER (TO BE COMPLETED BY PURCHASER & MANUFACTURER)

☐ KW @ RPM	☐ Manufacturer
☐ Service factor	☐ Type
☐ Frame No.	☐ Bearings
☐ Volts / phase / hertz	☐ Lube
☐ Temperature rise ^0C	☐ Insulation
☐ Full load amps.	☐ Enclosure
☐ Locked - rotor amps.	Remarks:
Vertical shaft ☐ Hollow ☐ Solid	
☐ Vertical thrust capacity, Kg Up Down	

VERTICAL PUMPS (TO BE COMPLETED BY PURCHASER & MANUFACTURER)

(For vertical pumps attach Format No. 01FT010 X)

☐ Pit or sump depth mm		Float & rod	☐ Carbon steel ☐ Stainless steel ☐ Bronze ☐ None
☐ Pump length mm (mount plate to suction flange)			☐ Float switch
☐ Minimum submergence reqd. mm		Pump thrust, Kg	☐ At min. flow ☐ At design flow ☐ At run out ☐ Up ☐ Down
Column pipe	☐ Flanged ☐ Threaded		
Line shaft	☐ Open ☐ Enclosed		
Guide bushings	☐ Bowl ☐ Line shaft		
Guide bushing lube ☐ Water ☐ Oil ☐ Grease ☐		Remarks :	
☐ Lube fluid Quantity M^3/hr Pr Kg/cm^2_G			

WEIGHTS (TO BE COMPLETED BY PURCHASER & MANUFACTURER)

Weight of pump & base plate	Kg	Remarks:
Weight of motor	Kg	
Weight of turbine	Kg	

PACKING AND SHIPPING

Packing type	☐ Domestic	☐ Export
Packing specs.	☐ Mfr's standard	☐ Purchaser's specs.
Packed weight	Kg	
Packing size	(LXBXH) mm	
Shipping by	☐ Rail ☐ Road	☐ Ocean ☐

Notes:

1) Pump shall be capable of running dry for few minutes.
2) Equipment shall be designed to be suitable for outdoor installation without a roof.
3) Bearing must have greasing provision
4) The scope of supply include the following items.
   a) Pumps, b) Drive Motors, c) Gland packing ~~Mechanical Seals~~, d) ~~Minimum flow recirculation valve~~ e) Couplings,
   f) Coupling Guards,g)Base Plate, h) Anchor Bolts with nuts, i) Piping confined to battery limit, j) Mating flanges for suction -
   and dischargenozzles k) Mandatory spares, l) Commissioning spares - VTS, m) First-fill of lubricants - VTS.
5) Flange Rating : Flange rating for pump shall have a minimum requirement, confirm to the dimentional requirement of ISO 7005-1 PN 50 and Equivalent to ANSI/ASME B 16.5 class 150#
6) MAWP: It should be at least the max discharge pressure + 10% of the max differential pressure.
7) Downstream design Pressure is 1.5 Times of Max operating pressure. Maximum Shutoff considering max suction pressure, including all tolerances shall not exceed this value.
8) Corrossion allowance for MOC other than CD4MCu: 3 mm

DATA SHEET	GENERAL REQUIREMENT FOR ELECTRICS	32644-13-DA-90002	
		Page 1 of 1	R0

1.0	**Project**	**Construction of Phosphoric Acid storage tank at Q10 W. Island**
2.0	**Owner**	FACT-CD
3.0	**Location**	Willington Island, Kochi
4.0	**Service conditions**	
4.1	Altitude	< 1000m above mean sea level
4.2	Humidity Min	64%
4.3	Humidity max.	93%
4.4	Humidity design	100% at 40^0C
4.5	Ambient temperature ^{0} C-Min.	19.2
4.6	Ambient temperature ^{0} C-Max.	34.3
4.7	Ambient temperature ^{0} C-Design	40
4.8	Rain fall – Max . Record in an hour	40mm
4.9	Rain –fall Max record in 24 Hours	169.5mm
5.0	**Environment**	Coastal area. Presence of salts and corrosive gases
6.0	**Wind velocity for structural design**	124 km/h
7.0	Seismic factor for design	Within seismic Zone 3 as per IS 1893
8.0	Soil data	
8.1	Soil resistivity	
8.2	Type of soil (hard / loose)	
9.0	**Power system**	
9.1	Voltage (V) & Variation (± %)	433V +/- 10%
9.2	Frequency (Hz) & Variation (± %)	50Hz +/- 5%
9.3	No of phases	Three
9.4	No. of wires	Four
9.5	Fault level (MVA)	35
9.6	Method of neutral earthing	Solid earthing

					PROJECT	**Construction of Phosphoric Acid storage tank at Q10 W. Island**
					CLIENT	**FACT-CD**
					P.O. NO.	
0	**12-02-'21**	**LN**	**SM**	**IK**	**VENDOR**	
REV.	**DATE**	**PRPD.**	**CHKD.**	**APPRD.**		

FACT ENGINEERING AND DESIGN ORGANISATION

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13FT900A/14

1.0	**Driven equipment details – TO BE FURNISHED BY DRIVEN EQPT. VENDOR**				
1.1	Equipment number & Name of equipment	P-3202 A/B -Phosphoric Acid Transfer pumps P-3203 A/B -Phosphoric Acid Sump pump P-3204 –Rain water pit pump			
1.2	Type of equipment				
1.3	Absorbed [power				
1.4	Rated speed				
1.5	Speed torque curve				
1.6	GD^2 value of rotating parts with reference to motor shaft in Kgm^2 at motor speed				
1.7	Type of drive transmission				
1.8	Additional details / questionnaire for the selection of motors				
2.0	**Motor details**				
2.1	Operating conditions				
	a) Rated Voltage & Frequency	415V +/- 10%, 50Hz +/- 5%, 3 phase AC			
	c) Maximum ambient temperature	40 ^{0} C			
2.2	Type of motor (Clause 5.1.0)	Squirrel cage induction motor, Energy efficient –IE3			
2.3	Rated output in KW	To be furnished by driven equipment. vendor			
2.4	Rated speed in RPM	- do -			
2.5	Type of mounting	- do -			
2.6	Class of duty as per IS: 325 (Clause 4.1)	S1			
2.7	Hazardous area classification (Clause 4.2)	Safe area			
2.8	Method of starting (Clause 5.1.0)	DOL			
2.9	Limit of starting current (Clause 5.2.3)	As per IS 12615			
2.10	Number of permissible starts (Clause 6.1.0)	a) 3 successive cold starts B) 2 successive hot starts c) 4 uniformly spaced starts per hour			
2.11	Suitability for automatic restart (Clause 4.6.0)	☐	Not required	■	Required with 100% out of phase residual voltage
2.12	Insulation class (Clause 7.1.0)		Class F with temperature rise limited to Class B		
21.3	Enclosure (Clause 8.2.0)	IP W55, Weatherproof			
2.14	Frame size (Clause 8.4.0)	As per IS			
2.15	Capacitors at motor terminals (Clause 8.6.0)	■	Not required	☐	Required of rating ……..
2.16	Location	☐	Indoor	■	Outdoor

2.17	Cable glands a) Power Cable (Clause 8.6.0)	Required to suit cable sizes			
	b) Anti-condensation heater	Required to suit the cable size of 3x4 sq mm YFY/YWY cable			
2.18	Fault withstand time of T.Box (Clause 12.3.0)	System fault level of 35 MVA for 0.25 seconds			
2.19	Size of earth conductor (Clause 13.1.0)	PVC covered Al cable (size shall be not less than half of power cable.)			
2.20	Anti-condensation heater (Clause 17.1.0)	Required (with Voltage rating of 240V), for motors of rating 37 kW & above			
2.21	RTD/Thermistor with control relay (Cl. 18.1.0)	☐	Required	■	Not required
2.22	Painting (Deviations if any on those specified in 13ES900)	Epoxy painting			
2.23	Make of motors	KIRLOSKAR ELECTRIC / SIEMENS / BHARAT BIJLEE / BHEL / JYOTI LTD / ABB LIMITED			
2.24	Size of cables	Actual sizes of cables will be furnished during issue of purchase order. Terminal box with cable gland to suit the same shall be provided.			
2.24.1	Minimum sizes of cables shall be as follows for different motor ratings (DOL starting)				
2.24.1.1	Motors ≤ 3.7 kW	1 # of 3 x 4 sq.mm Cu			
2.24.1.2	Motors>3.7kW ≤7.5 kW	1 # of 3 x 6 sq.mm .Al			
2.24.1.3	Motors>7.5kW ≤11 kW	1 # of 3 x 10 sq.mm			
2.24.1.4	Motors>11kW ≤15 kW	1 # of 3 x 16 sq.mm			
2.24.1.5	Motors>15kW ≤22 kW	1 # of 3 x 25 sq.mm			
2.24.1.6	Motors>22kW ≤30 kW	1 # of 3 x 35 sq.mm			
2.24.1.7	Motors>30kW ≤37 kW	1 # of 3 x 50 sq.mm			
2.241.8	Motors>37kW ≤45 kW	1 # of 3 x 70 sq.mm			
2.24.1.9	Motors>45kW ≤55 kW	1 # of 3 x 95 sq.mm			
2.24.1.10	Motors>55kW ≤60 kW	1 # of 3 x 150 sq.mm			
2.24.1.11	Motors>60kW ≤75 kW	1 # of 3 x 185 sq.mm			

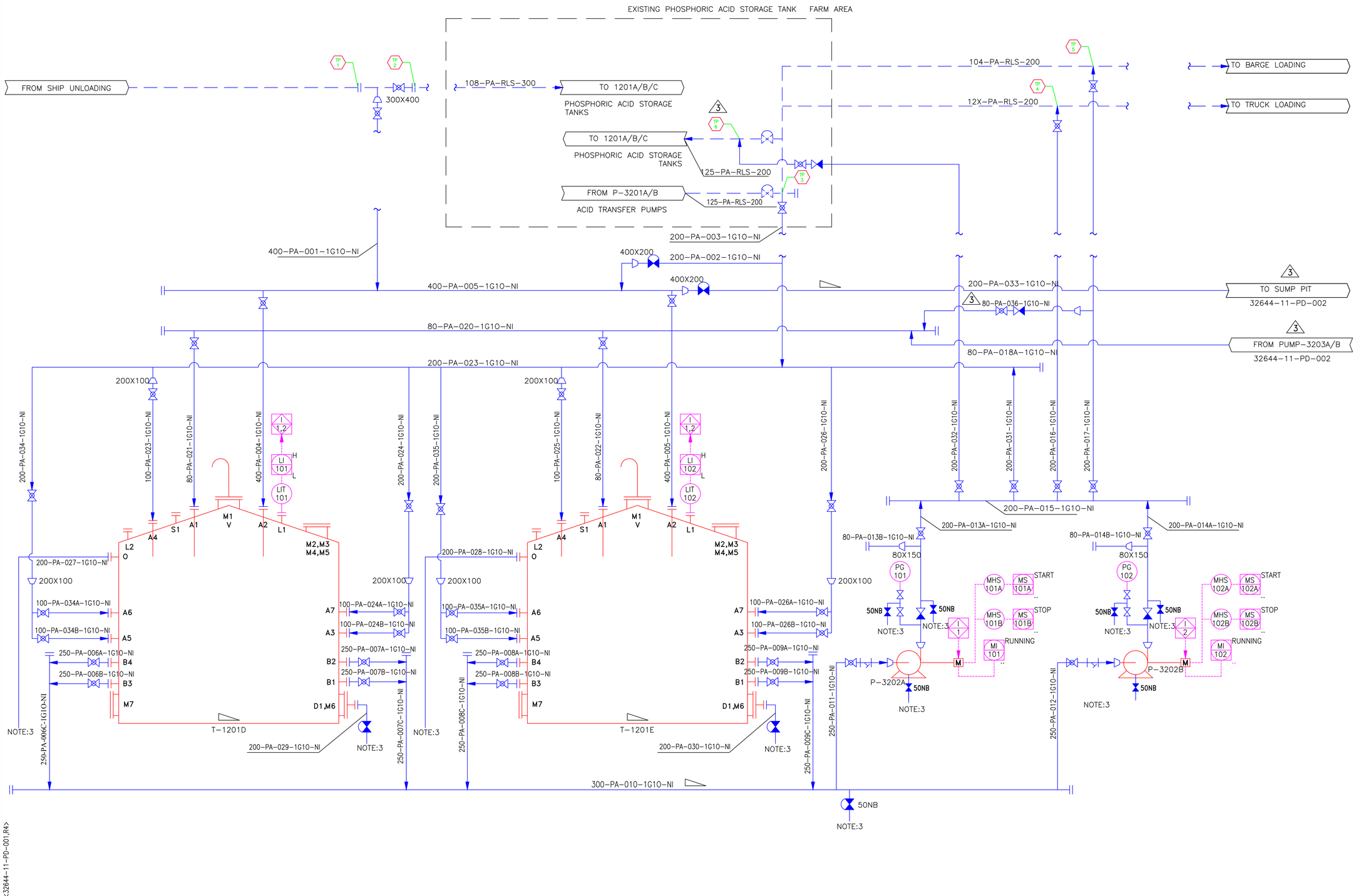
1.0	Make of motors	
2.0	Applicable codes / standards	
3.0	Equipment No.	
4.0	Continuous rating in KW (Clause 4.1.0)	
5.0	Rated voltage & frequency	
6.0	Speed in RPM (syn)	
7.0	Frame size (Clause 8.4.0)	
8.0	Method of starting	
9.0	No load current	
10.0	Full load current	
11.0	Starting current (%FLC) (Clause 5.2.3)	
12.0	Full load torque (Nm)	
13.0	Starting torque (%FLT)	
14.0	Pull up torque (%FLT)	
15.0	Pull out torque (%FLT)	
16.0	Slip (%) (Clause 4.5.0)	
17.0	Efficiency (%) and power factor	
17.1	At full load	
17.2	At 3/4 load	
17.3	At 1/2 load	
18.0	Stator resistance	
19.0	Locked rotor current	
20.0	Locked rotor withstand time	
20.1	Hot (seconds)	
20.2	Cold (seconds)	
21.0	Starting time of motor on DOL with driven equipment coupled	
21.1	At 100% voltage	
21.2	At 80% voltage	
22.0	Minimum voltage required for starting with equipment and corresponding starting time	
23.0	Pull out voltage at full load	
24.0	Allowable number of starts with driven equipment (Clause 6.0.0)	

24.1	Successive starts from cold condition	
24.2	Successive starts from hot condition	
24.3	Uniformly spaced starts per hour	
25.0	Time interval required for restarting the motor after the permissible successive starts	
26.0	Guaranteed temperature rise under worst conditions of voltage and frequency	
27.0	Maximum allowable sustained voltage drop and time in seconds the motor can be kept running with full load without exceeding the permissible temperature rise	
28.0	Design class of rotor as per NEMA standards	
29.0	GD^2 value of rotating parts in Kg/m^2 at rated speed	
30.0	Speed v/s torque curve	
31.0	Current v/s time curve (with driven machine)	
32.0	Current v/s speed curve	
33.0	Thermal withstand characteristics (hot & cold)	
34.0	Start withstand time	
34.1	Hot (seconds)	
34.2	Cold (seconds)	
35.0	CMRS Certificates (for Flame - proof motors)	
36.0	Capacitors	
36.1	Maximum rating of capacitors in KVAR that can be connected to motor terminals (Clause 8.6.0)	
36.2	Terminal box for capacitor / star delta starter (Clause 12.9.0)	
37.0	Bearings (Clause 10.0)	
37.1	Drive end bearing No. & type	
37.2	Non drive end bearing No. & type	
37.3	Make of bearings	
38.0	Lubricants (Clauses 10.2.0, 10.6.0 & 10.7.0)	
38.1	Make	
38.2	Type & grade	
38.3	Lubrication schedule of motor	
39.0	Percentage residual voltage reconnection allowed (Clause 4.6.0)	
40.0	Slip ring motors	
40.1	Rotor open circuit voltage	
40.2	Rotor current	
40.3	Make of brush	

40.4	Grade of brush	
40.5	Details of starting resistance	
40.6	Type of rotor winding	
41.0	Net weight of motor	
42.0	Shipping weight of motor	
43.0	Shipping volume of motor	
44.0	Critical speed (Clause 4.4.0)	
45.0	Margin between starting time and thermal withstand time (hot) as per clause 5.2.2	
46.0	Material of external screws, bolts, & nuts (Clause 8.1.0)	
47.0	Maximum vibration and noise levels (Clause 8.3.0)	
48.0	Ventilation	
48.1	Method of ventilation (Clause 9.1.0)	
48.2	Material of construction of fans & tubes (Clause 9.2.0)	
48.3	Whether bidirectional, if not, direction of rotation (Clause 9.3.0)	
49.0	No. of auxiliary terminal boxes and their purpose (Clause 12.7.0)	
50.0	Anti condensation heaters (Clause 17.0.0)	
51.0	Details of thermistors and thermistor control relay (Clause 18.1.0)	
52.0	Insulation class of winding (Clause 7.1.0)	
53.0	Protective coatings / treatments provided (Clause 7.4.0)	
54.0	Enclosure (Clause 8.2.0	
55.0	Mounting	
56.0	Special requirement (Clauses 21.2.0)	
57.0	Foundation rails, nuts, bolts, etc (Clause 8.8.0)	
58.0	Additional accessories / requirements (Clause 21.1.0)	
59.0	Coupling / pulley (Clause 16.1.0)	
60.0	Whether motor is energy efficient as per IS:12615	
61.0	Cable gland type & size	

EQUIPMENT	STORAGE TANK
TAG NO.:	T–1201D/E
TYPE:	VERTICAL, CONE ROOF
SERVICE:	54% PHOSPHORIC ACID SOLN.
DIMENSION:	ID:22,000 MM X HT.:10,500 MM
CAPACITY:	5930 MT (GROSS) 3
OP. CONDITION:	ATM. PR & AMBIENT TEMP.

EQUIPMENT	TRANSFER PUMP
TAG NO.:	P–3202A/B
TYPE:	HORIZONTAL, CENTRIFUGAL
SERVICE:	54% PHOSPHORIC ACID SOLN.
CAPACITY:	175 M3/H
POWER:	...
OP. CONDITION:	....

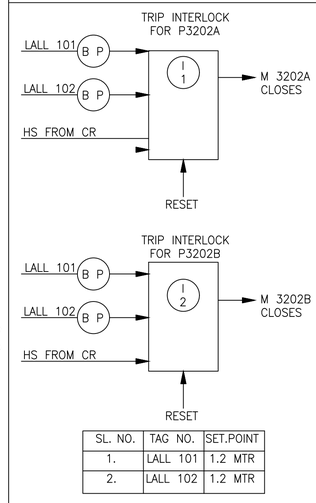


NOTES

1. P&ID SHOWN IS INDICATIVE ONLY. EXISTING TANKS 1201A/C NOT SHOWN. REFER TO DRG. NO. 8213.0044-0601/1, & 32294-11-PD-001 FOR DETAILS OF EXISTING PHOSPHORIC ACID STORAGE TANKS.
2. LOCATION OF TIE-IN POINTS TO BE FINALIZED.
3. TANKS OVERFLOW & TANK/PUMP DRAINS SHALL BE ROUTED TO OPEN DRAIN CHANNELS SHALL BE DIVERTED TO RAIN WATER PIT AND SUMP PIT WITH SUITABLE ISOLATION VALVES.
4. CURRENTLY BARGE UNLOADING FACILITY DOESNOT EXIST HENCE THE FOLLOWING LINE NUMBERS(134-PA-RLS-80,80-PA-019-1G10-NI) ARE DELETED. 3

PA - PHOSPHORIC ACID (CONTAINS 54% P_2O_5 2-4% SULPHURIC ACID, 1-2% GYPSUM SOLIDS).

1G10 - 150 RATING, ASTM A106 GR.B, RUBBER LINED.

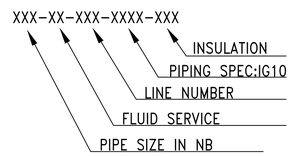


SL. NO.	TAG NO.	SET.POINT
1.	LALL 101	1.2 MTR
2.	LALL 102	1.2 MTR

LEGENDS

- EXISTING
- NEW
- TP ... TIE–IN POINTS
- A INLET
- B OUTLET
- D DRAIN
- L LEVEL INDICATOR
- M MAN HOLE
- NI NO INSULATION
- O OVER FLOW
- V VENT
- S SPARE NOZZLE
- NORMALLY CLOSED VALVE
- BALL VALVE
- DIAPHRAGM VALVE

LINE IDENTIFICATION



A1

CLIENTS: M/s. FACT–CD

DRAWING NO.	TITLE
32294–11–PD–001	NEW PHOSPHORIC ACID TANK AT W.ISLAND
8213.0044–0601/1	IMPORT HANDLING FOR IMPORTED PHOSPHORIC ACID

REFERENCE DRAWING

NO	ZONE	PARTICULARS	REVISED	CHECKED	APPROVED	DATE
4	ZONE	ISSUED FOR WORK ORDER	ST	BV/MR	KVR	09/02/2021
3	ZONE	COMMENTS INCORPORATED	ST	BV/MR	KVR	01/07/2020
2	ZONE	CLIENT COMMENTS INCORPORATED	ST	BV/MR	KVR	19/06/2020
1	ZONE	AS MARKED	ST	BV	KVR	10/06/2020

REVISION

SCALE	NTS
DATE	19/05/2020
DRAWN	ST
CHECKED	MR
DESIGNED	BV
CHECKED	KVR
APPROVED	KVR

FACT ENGINEERING & DESIGN ORGANISATION
THE FERTILISERS AND CHEMICALS TRAVANCORE LTD
UDYOGAMANDAL KERALA

PROJECT NAME: CONSTRUCTION OF ADDITIONAL PHOSPHORIC ACID STORAGE TANKS AT QTO BERTH,WI
PROJECT NO: 32644

TITLE: P&ID FOR PROPOSED PHOSPHORIC ACID STORAGE TANKS (T–1201D/E)

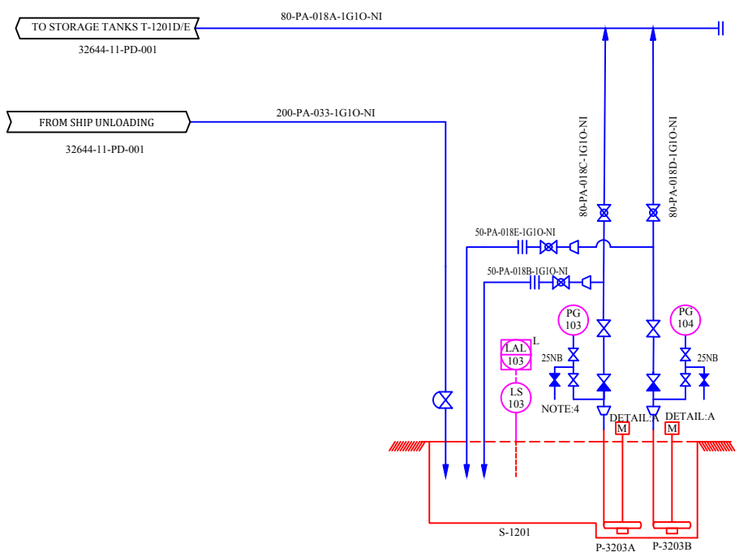
DRG. NO: 32644–11–PD–001 | SHEET 1 of 1 | REV. NO: 4

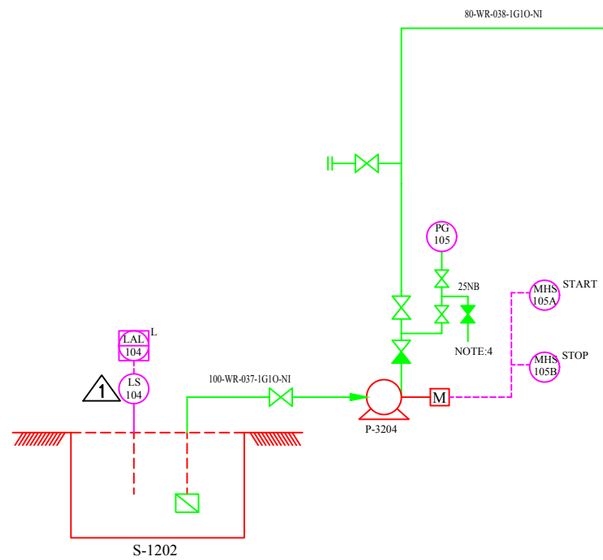
EQUIPMENT	RAIN WATER PIT (HOLD)
TAG NO.:	S-1202
TYPE:	ACID PROOF BRICK LINED
SERVICE:	WATER
DIMENSION:	L-2,000 MM X W-2,000 MM X DEPTH-2,000 MM
CAPACITY:	8 M^3
OP. CONDITION:	ATM. PR & AMBIENT TEMP.

EQUIPMENT	RAIN WATER PIT PUMP
TAG NO.:	P-3204
TYPE:	HORIZONTAL, CENTRIFUGAL
SERVICE:	WATER
CAPACITY:	25 M^3/H
POWER:	...
OP. CONDITION:	

EQUIPMENT	SUMP NOTE:5
TAG NO.:	S-1201
TYPE:	ACID PROOF BRICK LINED
SERVICE:	54% PHOSPHORIC ACID
DIMENSION:	1 L-5,000 MM X W-5,000 MM X DEPTH-2,000 MM
CAPACITY:	50 M^3 1
OP. CONDITION:	ATM. PR & AMBIENT TEMP.

EQUIPMENT	SUMP PUMP NOTE:5
TAG NO.:	P-3203A/B
TYPE:	VERTICAL, CENTRIFUGAL
SERVICE:	54% PHOSPHORIC ACID
CAPACITY:	25 M^3/H
POWER:	...
OP. CONDITION:	...





NOTES

1.ACID RECEIPT HEADER (FROM SHIP) AT TANK FARM AREA, RE-CIRCULATION & RECLAMATION HEADERS SHALL BE PROVIDED WITH SUITABLE DRAIN
PROVISION (AT LOWEST POINT) TO EMPTY INTO THE SUMP.

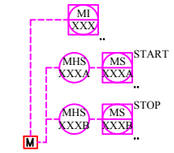
2.TOTAL VOLUME INDICATED FOR S1201,S1202 IS TENTATIVE,SHALL BE FINALISED DURING CONSTRUCTION.

3.CLOSED ROOFS SHALL BE PROVIDED FOR S1201.
4.TANKS OVERFLOW & TANK/PUMP DRAINS SHALL BE ROUTED TO OPEN DRAIN CHANNELS SHALL BE DIVERTED TO RAIN WATER PIT AND SUMP PIT WITH SUITABLE ISOLATION VALVES.

5.SUMP VOLUME & PUMP CAPACITY INDICATED IS TENTATIVE CAN BE FINALIZED DURING DETAILED ENGG.

PA - PHOSPHORIC ACID (CONTAINS 54% P_2O_5 2-4% SULPHURIC ACID, 1-2% GYPSUM SOLIDS)
1G1O - 150 RATING, ASTM A106 GR.B, RUBBER LINED

DETAIL:A



LEGENDS

- NORMALLY CLOSED VALVE
- BALL VALVE
- DIAPHRAGM VALVE
- GATE VALVE
- FOOT VALVE

<32644-11-PD-002,R2>

A3

CLIENTS : M/s FACT-CD

DRAWING No:	No	ZONE	PARTICULARS	REVISED	CHECKED	APPROVED	DATE
REFERANCE	REVISION						
	2		ISSUED FOR WORK ORDER	ST	BV	KVR	09/02/2021
	1		COMMENTS INCORPORATED	ST	BV	KVR	17/7/2020

SCALE	NTS
DATE	01/07/2020
DRAWN	ST
CHECKED	BV
DESIGNED	BV
CHECKED	MR
APPROVED	KVR

FACT ENGINEERING & DESIGN ORGANISATION
THE FERTILISERS AND CHEMICALS TRAVANCORE LTD
UDYOGAMANDAL KERALA

PROJECT NAME: CONSTRUCTION OF ADDITIONAL PHOSPHORIC ACID STORAGE TANKS AT Q10 BERTH,WI
PROJECT No: 32644

TITLE: P&ID FOR PROPOSED RAIN WATER PIT & SUMP PIT

DRG. No. 32644-11-PD-002 | SHEET NO 1 OF 1 | REV. 2

CONTENTS

1.0.0. SCOPE

1.1.0. This document together with "VENDOR DATA REQUIREMENTS (VDR)" defines FEDO's requirements for vendor drawing and data for any enquiry, work order or purchase order.

1.2.0. Bidders unable to comply with these requirements must detail all exceptions in their proposal. The timely delivery of quality drawings and data is as crucial as delivery of the equipment itself and hence the same shall be strictly adhered to after commitment.

1.3.0. Failure to provide adequate preliminary data / drawing may render a proposal non-responsive and hence may be rejected. After commitment failure to provide documents as per purchase order may delay progressive payments and adversely affect future invitation to bids.

2.0.0 VENDOR DATA REQUIREMENTS (VDR)

2.1.0 FEDO will provide a partially completed VDR form along with each enquiry. This form explains group code of the document, quantity of each document required and lead time for submission. Columns are available for the vendor to fill in his deviations, if any, from FEDO's requirements.

2.2.0 The vendor shall forward a filled-in VDR form along with his offer, if he has got any deviation from FEDO's requirements. In the absence of a filled-in VDR form along with the offer, it will be presumed that the vendor is accepting FEDO's requirements specified in the VDR.

3.0.0. CLASSIFICATION OF DOCUMENTS

3.1.0. Documents are classified based on their status and nature of content.

3.1.1. Status of documents:

1. Preliminary documents required along with the offer.
2. Documents to be submitted after commitment.
3. Final documents.

3.2.0. The documents are further classified into Groups A,B and C, depending on the nature of the documents as explained below.

3.2.1. Group A requirements

These documents are urgent in nature and contain information that is required for proceeding with the detailed engineering of surrounding / down stream equipments in the plant and hence are to be submitted on priority basis.

3.2.2. Group B requirements

These documents are to be reviewed by FEDO for compliance with the purchase order / work order specifications but are not essential for other engineering activities of FEDO.

3.2.3. Group C requirements

Documents in this group contains data / information / records which are final in nature and that are required for the equipment user and need not be reviewed by FEDO.

4.0.0. VENDOR DATA INDEX (VDI)

4.1.0. Vendor shall forward a filled up and updated VDI along with each vendor data transmittal. VDI shall list out all documents that are being prepared for the particular order, their current revision status and indicate the documents included in the present transmittal. A blank VDI is attached along with this document, which shall be used for this purpose.

5.0.0. QUALITY OF VENDOR DRAWINGS

5.1.0. Vendor drawing and data shall be supplied in full size drawings, reproducible and CDs as specified in the VDR.

5.2.0. All drawings / documents shall be clear, legible, right reading and made out of originals prepared in black ink. English language and metric units shall be used for the preparation of all documents.

5.3.0. The documents shall be prepared n any of the following standard sizes.

5.3.1. A1: 594 mm x 840 mm
5.3.2. A2: 420 mm x 594 mm
5.3.3. A3: 297 mm x 420 mm
5.3.4. A4; 210 mm x 297 mm

5.4.0. All documents submitted to FEDO shall be folded into A4 size (210 x 297 mm) except originals / re-producible which may be rolled. All reproducible shall be in high quality polyester films. Soft copies shall be furnished in CD for final drawings / documents.

5.5.0. Each drawing / document shall have a title block at the right hand bottom corner with the following information.

5.5.1. Name of Vendor.
5.5.2. Drawing title.
5.5.3. Name of Project, Owner and location.
5.5.4. Name of Consultant: FEDO
5.5.5. FEDO Purchase Order Number.
5.5.6. Equipment name & Number
5.5.7. Drawing number, revision and page number.

5.6.0. All drawings shall be drawn to some standard scales only and the same shall be indicated in the drawing.

5.7.0. The status of the document like "PRELIMINARY, FINAL, FOR REVIEW" etc. shall be stamped on all copies forwarded to FEDO.

5.8.0. All documents shall have a block of 100 mm x 100 mm space left vacant for FEDO to put their stamp after review.

5.9.0. All drawing/document shall have a revision block explaining revision number, revision description, data of revision, revision authorization etc. When the revised drawings are submitted all currently revised area shall be clearly demarcated by clouding. Any revisions made on other parts of the documenting will not be reviewed by FEDO.

5.10.0. When drawings are received back from FEDO with comments, vendor shall incorporate all the comments and resubmit the same. If the vendor is not in a position to incorporate certain comment made by FEDO, then the reason for such deviation shall be highlighted in the forwarding letter to FEDO.

5.11.0 The respective engineering specification and other purchase order spec. Will explain the minimum data / details required in various drawings. In the absence of any such information in the purchase order documents, vendor shall follow the standard good engineering practices in detailing the drawing.

6.0.0. CONDITIONS OF FEDO REVIEW

6.1.0. FEDO and / or its client reserve the right to review the vendor documents. FEDO's REVIEW WITH OR WITHOUT COMMENTS OF THE VENDOR DOCUMENTS SHALL NOT RELIEVE THE VENDOR OF RESPONSIBILITY TO COMPLY WITH ALL PURCHASE ORDER TERMS AND CONDITIONS, including all implied requirements relating to fitness for service and good engineering practices. Approval or acceptance does not imply or infer any determination relating to compliance by the vendor with its full

responsibilities under the purchase order.

6.2.0. FEDO's comments are limited to identifying requirements within the scope of the purchase order or failure by the vendor to comply with the requirements of purchase order, as revealed by the limited review. Oversights in the above limited review cannot be taken as approval for the vendor to deviate from the purchase order conditions. FEDO reserve the right to point out any such deviations at any stage of the order execution. The vendor shall comply with all such requirements without any price / delivery implications.

6.3.0. FEDO review will be authorized by an official stamp as given below, properly filled and signed by the concerned. Comments if any will be indicated in red ink or clouded in the case of copies of commented drawings.

Appropriate comment in the 'comments' column and 'status of review' column will be marked.

Comment	Status of Review
As noted	Revise and resubmit for review
No comments	Proceed as noted and submit revised docs. For records
Not reviewed	No further review required
	Forward final docs. As per P.O.

6.4.0. All documents received in FEDO shall be dispatched after review within 15 days from the date of receipt. Vendor shall notify FEDO of non-receipt of reviewed documents in time immediately, to take corrective actions.

6.5.0. The delivery of the equipment shall in no case be linked with the review of the vendor drawings and data by FEDO. It is the sole responsibility of the vendor to execute the job as per the purchase order conditions. If required the vendor shall depute his technical personnel to FEDO after submission of documents for timely finalisation of documents.

****

CONTENTS

1.0.0 SCOPE

This specification covers the engineering requirements for horizontal and vertical centrifugal pumps for general purpose services.

1.2.0 Special requirements of the project.

Special requirements of the project attached to this specification cover modifications to this specification, customer's special or local requirement as well as specific job data pertinent to this specification. Where special requirements of the project are in contradiction to this specification, special requirements of the project shall govern.

2.0.0 REFERENCES

The requirements contained in the latest editions (unless otherwise indicated) of the following specification, standards and code shall form part of this specification, in the manner and to the extent indicated herein.

1. ANSI B1.1 : Unified Inch Screw Threads (UN and UNR Thread Form)
2. ANSI B2.1 : Pipe Threads (Except Dryseal)
3. ANSI B4.1 : Preferred Limits and Fits for Cylindrical Parts
4. ANSI B16.5 : Steel Pipe Flanges, Flanged Valves and Fittings
5. ANSI B31.3 : Chemical Plant and Petroleum Refinery Piping
6. ASME Boiler and Pressure Vessel Code
   a. Section III, Division 1
   b. Section V, Nondestructive Examination
   c. Section VIII, Divisions 1 and 2
7. Hydraulic Institute Standards for Centrifugal , Rotary &Reciprocating Pumps.
8. AFBMA (Anti Friction Bearing Manufacturers' Association) Standards for Ball and Roller Bearings and Steel Balls.
9. MSS (Manufacturers Standardisation Society of the valve and fittings industry) Standards.

3.0.0 DEFINITIONS

The following terms as used in this specification shall have the meanings denoted:

1. Max. Allowable Casing Working Pressure

   The greatest discharge pressure at the specified pumping temperature for which the pump casing is designed. Designs shall conform to the requirements of this specification. The pressure shall be equal to or greater than max. discharge pressure.

2. Maximum Discharge Pressure

   The maximum possible suction pressure to be encountered, plus the maximum differential pressure the pump is able to develop when operating at the specified conditions of speed, specific gravity and pumping temperature with the furnished impeller. For vertical pumps, the pressure shall be referenced to bottom of base plate.

3. Rated Discharge Pressure

   The discharge pressure of the pump at the guarantee point related to rated capacity, speed, suction pressure and liquid specific gravity. For vertical pumps, the pressure shall be referenced to bottom of base plate.

4. Maximum Suction Pressure

   The highest suction pressure to which the pump is subjected during operations. For vertical pumps, the pressure shall be referenced to bottom of base plate .

5. Rated Suction Pressure

   The suction pressure for the operating conditions at the guarantee point. For vertical pumps, the pressure shall be referenced to bottom of base plate.

6. Rated Speed

   The normal operating speed (in rpm) on which the pump performance ratings and guarantees are based. For motor-driven pumps, rated speed shall be the actual speed of motor based on test report or drawings of the motor.

7. Rated Brake Horsepower

   The horsepower required by the pump at the specified rated operating conditions, including capacity, pressures, specific gravity and viscosity.

8. Pressure Casing

   All major stationary pressure containing components of the pump unit, including all attached nozzles and other components, but excluding the shaft and shaft sleeves.

9. Net Positive Suction Head Available

   $NPSH_A$ is determined by the purchaser based on the pumping system requirements. $NPSH_A$ is the total suction head in metres of liquid absolute - referred to the pump centerline for horizontal pumps and to the top of the foundation for vertical pumps - minus the vapor pressure of the liquid at pumping temp. in meters absolute.

10. Net Positive Suction Head Required

    $NPSH_R$ is determined by the pump manufacturer and is expressed as metres

of liquid (water) required at the pump centerline for horizontal pump or at the top of the foundation for vertical pumps for the specified capacity.

11. Submergence

    The minimum liquid level above the suction port necessary to prevent vortexing or cavitation.

12. Minimum Flow

    Based on the fluid characteristics, the lower flow rate at which the pump can continuously operate without danger of failure.

4.0.0 DESIGN AND MANUFACTURE

4.1.0 Pump Selection

4.1.1 Pump head - capacity curves shall continuously rise from rated capacity to shutoff unless otherwise approved by the purchaser. The rated capacity point shall be at or to the left of the peak efficiency point on the head - capacity curve for the rated impeller diameter unless otherwise approved by the purchaser.

4.1.2 The correction factors given in the 13th edition of the Hydraulic Institute standards shall be used for sizing pumps handling liquids more viscous than water. An NPSH correction factor shall not be used.

4.1.3 Turbine-driven pumps shall be designed to operate continuously at 105% of rated speed and, under emergency conditions, at 120% of rated speed (turbine overspeed trip setting).

4.1.4 All equipment shall be designed for operation outdoors totally unprotected from the elements.

4.1.5 All instruments and valves, including auxiliary systems, shall be securely mounted and supported to avoid damage during shipment, storage, operation and maintenance.

4.1.6 For pumps with vertical sumps, the pump manufacturer shall state the minimum submergence required and the minimum clearance from the sump bottom.

4.1.7 Pump shall be designed so that the maximum allowable sound levels are not exceeded while operating at specified conditions.

4.1.8 Pump selection shall be such that it shall be possible to obtain an increase in differential head to the order of 105% for the rated head by changing the impeller with the same casing.

4.1.9 Pumps shall be suitable for continuous duty unless otherwise specified.

4.2.0 MECHANICAL DESIGN

4.2.1 Pump Casing

1. Pressure casings shall be sufficiently thick to withstand the maximum discharge pressure at pumping temperature and hydrostatic test pressure at ambient temperature. All casings shall have a minimum 3.2mm corrosion allowance unless otherwise specified.

2. The design stress, temperature restrictions and other requirements for materials shall conform to the limitations in the ASME code, Section VIII, Division 1 for similar material.

3. Pressure containing components shall be manufactured in accordance with the ASME code, Section VIII, Division 1. The manufacturers' data report forms and stamping specified in the ASME Code are not required.

4. All vertical and horizontal pumps shall be furnished with flanged suction and discharge nozzles that conform to ANSI standards unless otherwise specified. Pump suction and discharge nozzle of 32NB, 65 NB, 125 NB and 225 NB are not preferred. If the pump manufacturer's standard design offers a flange thickness and diameter greater than necessary for the specified rating, the heavier flange may be furnished, but it shall be faced and drilled as specified. Flange bolt holes shall straddle the centrelines.

5. Each stage of a pump shall be self venting by arrangement of the nozzles or be provided with a vent connection. All horizontal pumps and vertical in-line pumps shall be provided with a drain connection. Vent and casing drain connections shall be 15NB minimum.

6. Pumps shall be provided with suitable means, such as eyebolts, lugs or jackscrews, to facilitate disassembly of gasketed joints.

7. The casing shall be supported by feet beneath the casing or any other suitable support between the casing and the baseplate.

4.2.2 Impellers

1. Impellers shall be of one piece fabrication. Major components of rotating elements, such as the impellers and balancing drums, shall be individually statically balanced. In addition to static balancing, impellers shall be dynamically balanced if the pump is to be operated under any of the following conditions:

   a. At speeds over 1,800 RPM, where the rated capacity exceeds 60 M^3 /hr and the impeller diameter exceeds 152 mm (6 in.)

   b. At speeds over 1,800 RPM for two or more stages.

For pumps with impellers mounted between the bearings, the shaft and impellers shall first be individually balanced and then finally balanced as an assembled unit. After balancing, vibration shall be according to the limits specified in Subsection 4.2.4.

2. Impeller shall be fixed to the shaft using keys. Screwed type fixing is not recommended unless specifically accepted by purchaser.

4.2.3 Shafts and Shaft Sleeves

1. Replaceable shaft sleeves are required for all pumps. Shaft sleeves shall extend beyond the outer face of the gland and inward past the throat bushing.

2. The pump shaft or shaft sleeve runout measured by a dial indicator at the stuffing box face shall not exceed 0.05 mm total indicator reading.

4.2.4 Vibration

Peak-to-peak vibration limits shall apply to pumps with anti-friction bearings and sleeve bearings. The limits shall cover rotor vibration during shop and field tests at rated speed and throughout the full operating capacity.

Peak-to-peak limits in micrometers are as follows:

Rated Speed(RPM)	Anti-Friction Bearings *	Sleeve Bearings*
1,800 and below	75	75
1,801 to 3,600	50	50

* Measured on the bearing housings.

Critical speeds shall be at least 20% above or below the normal operating speed for pumps with flexible shafts and at least 20% above the maximum operating speed for pumps with stiff shafts.

4.2.5 Mechanical Shaft Seals

1. Mechanical seals shall be as specified in pump data sheets. If mechanical seal manufacturer has any alternate recommendation for seals, same shall be submitted for purchaser's consideration.
2. Seal end plates shall be of the same material or better as the pump casing, except that carbon steel plates shall be furnished for a cast iron, ductile iron or bronze casing. Seal end plates shall be retained by a minimum of four stud bolts.
3. Mechanical seal flush piping shall conform to Appendix 2. Seal flush piping shall be of 18 Cr- 8 Ni stainless steel material.
4. Heat exchangers used for cooling mechanical seal flushing streams shall have 15NB minimum size tubing for the process liquid. The tube material shall be a continuous fabrication. Material for the product side shall be 18Cr-8Ni stainless steel or as specified.
5. Horizontals pumps with impellers mounted between the bearings and vertical turbine type pumps shall be furnished with cartridge type mechanical seals.

4.2.6 Stuffing Boxes for Conventional Packing

1. Stuffing boxes shall have adequate number of rings of packing plus the lantern ring. Lantern rings shall have inlet and outlet liquid connection.
2. Stuffing box glands shall be easily removable and must permit replacement of packing without removal or disassembly of any other part of the pump. Glands shall preferably have complete bolt holes. Slotted holes, open at one side are acceptable only if studs are provided for securing the glands.

4.2.7 Drivers

1. Drivers and gears for vertical pumps shall be designed for the maximum up and down thrusts that the pump may develop during starting or stopping or while operating at any capacity.
2. Gear losses and transmission losses shall be added to the pump power consumption before driver rating factors are applied.
3. Motors for pumps covered by this specification shall have horsepower ratings at least equal to the following percentage of pump rated brake horsepower.

Motor Nameplate Rating, KW	Percent of Rated BHP
18.5 and less	125
Above 18.5 & below 75	115
75 and above	110

4. Motor or steam turbine drivers that are specified on the individual pump specification sheets as operating in parallel or without discharge control valves shall have a nameplate rating not less than the maximum power required by the pump when furnished with the specified diameter impeller.
5. The rated power of steam turbine drivers shall be 110% of the rated pump power, based on the guaranteed pump efficiency. The steam turbine power rating shall be based on the specified minimum initial steam conditions at the turbine inlet and the maximum exhaust pressure.

4.2.8 Couplings

1. Horizontal pumps shall have flexible couplings. Vertical pumps shall have rigid adjustable, spacer-type couplings when the pump thrust load must be carried by the bearings of a solid-shaft motor. Vertical pumps designed with integral thrust bearings shall be supplied with suitable all metal, nonlubricated couplings. (A spacer is required if it is possible to service the mechanical seal without completely disassembling the pump). Couplings for in-line pumps need not be adjustable.
2. The pump manufacturer shall mount the pump half-coupling. Gear and driver half couplings shall be furnished and mounted by the pump manufacturer unless otherwise specified.
3. Couplings shall be mounted on shafts with a cylindrical fit and keyed in place. Cylindrical fits shall conform to ANSI B4.1, Class FN-1.
4. Couplings shall be dynamically balanced when the size-speed relationship is such that balancing is recommended by the coupling manufacturer.
5. Removable all-metal coupling guards are required. They shall be sufficiently rigid to avoid contact with the coupling or shaft due to body contact.
6. Type of couplings shall be as specified in pump data sheet.

4.2.9 Bearings

1. Radial bearings shall be the standard available design (ball, roller, sleeve or pivoted shoe) unless otherwise specified by the pur-

chaser.

Anti-friction bearings shall be the standard type and selected to give three years (25,000 hrs) minimum (AFBMA) rating life with continuous operation at rated pump conditions and not less than 16,000 hrs at maximum axial and radial loads and rated speed. The rating life is the number of hours at constant speed that 90% of a group of identical bearings will complete or exceed before the first evidence of failure.

2. Horizontal pump bearings shall be arranged for oil lubrication.
3. Thrust bearings for vertical pumps shall not be located in the drivers.
4. Non pressure oil-lubricated bearings shall be equipped with 60 cc (minimum) constant level oilers. Constant level oilers shall be provided with protective wire cages.
5. If a complete lube oil system is required, it will be specified by the purchaser.

4.2.10 Piping

Piping shall terminate with a flanged connection. Piping shall be in accordance with ANSI B31.3 and flanges and flanged fittings in accordance with ANSI B16.5. Tapped openings and piping threads shall con form to ANSI B2.1 and B16.5.

1. Cooling Water

a. The cooling water systems shall be arranged for flow through the jacket, coolers, and glands specified on the individual pump specification sheet by a letter code from Appendix 3.

b. The system inlet and outlet shall be at the edge of the baseplate opposite the driver unless otherwise specified. The system shall be arranged for easy disassembly to permit maintenance and cleaning and shall be properly supported to prevent vibration and damage. Complete drainage is required. Closed sight flow indicators and inlet and outlet shut off valves are required for all closed cooling water systems.

c. If cooling water is required for a pump and driver, the pump manufacturer shall provide single inlet and outlet connections for the cooling water piping.

d. Cooling water jackets or housings shall be designed for a minimum 5.3 Kg/cm^{2}G working pressure unless otherwise specified.

e. Piping shall be 15NB minimum for pumps with discharge openings smaller than 80NB and 20NB minimum for pumps with discharge openings 80NB and larger. Pipe wall thicknesses shall be schedule 80 for nominal pipe sizes 15NB through 50NB and schedule 40 for nominal pipe sizes 80NB and larger.

f. Copper tubing conforming to ASTM B88, Type K (soft annealed) and brass fittings may be furnished for cooling water, if specified by purchaser. If copper or its alloy are specified as not suitable for the service, then AISI 316 tubing shall be used.

g. Cooling water systems shall be furnished by the pump manufacturer. They shall be fully assembled and installed on the pumps. Piping shall be thoroughly cleaned before connection to a pump. Piping on vertical pumps may be separately boxed for shipment.

2. Seal Flushing

a. Seal flushing systems shall be as specified on the individual pump specification sheet by a numeric code from Appendix 2. Systems shall be arranged for easy disassembly to permit maintenance and cleaning and shall be properly supported to prevent vibration and damage. The temperature and pressure rating of the system shall not be less than the pump casing maximum discharge pressure at the maximum pumping temperature.

b. If alloy pump casings are specified, all flushing system components shall be of equal specification or better than the casing material.

c. 18Cr-8Ni stainless steel tubing shall be used for flushing fluids to mechanical seals. The minimum size of tubing shall be 15NB. The minimum tubing wall thickness for 15NB and 20NB sizes shall be 1.65mm (0.065 inch). Tubing fittings shall be 18Cr-8Ni stainless steel.

d. Seal flushing systems, including all accessories such as gauges and valves, shall be furnished by the pump manufacturer. They shall be fully assembled and installed on the pumps. Piping shall be thoroughly cleaned before connection to a pump. Piping on vertical pumps, except in-line pumps, may be separately boxed for shipment.

4.2.11 Auxiliary Connections

1. Tapped openings and threads shall conform to ANSI B2.1 and B16.5. Auxiliary piping connections that are supplied but not piped shall be plugged with solid plugs. Carbon steel plugs shall be used for cast iron castings; otherwise, the materials for the plugs and casing shall be identical.

4.2.12 Baseplates and Mounting

1. All horizontal pumps shall be furnished with sturdy drain rim or drain pan-type baseplates with a raised lip. Baseplates material shall be as specified. They shall extend the full length and width of the pump and driver unit and shall be fully machined to receive pump and driver.
2. Basic requirements for baseplates are as follows:

a. Connections for drain shall be tapped 25NB in the raised lip at the pump side and shall be located to effect complete drainage. The pan or upper surface of the baseplate shall be sloped at least 10 mm per meter toward the drain.

b. A minimum of two 100 mm grout holes shall be provided in each baseplate. They shall be positioned to allow grouting with all the components in place and have vents to promote even grout distribution. Grout

holes shall have raised lips to prevent liquid accumulating on the exposed grout.

3. The centerlines of pump shafts shall be sufficiently high above baseplates for correct installation of all auxiliary piping connections such as pump drains, steam turbine inlet end drain and leakoff connections.

4. All vertical in-line pumps shall have a flat-bottomed casing.

4.2.13 Materials

1. Materials shall be as specified on the individual specification sheet.

2. Casings shall be sound, free from shrinkage holes, blowholes, scale, blisters and other defects. Surfaces shall be cleaned by the pump manufacturer's standard methods. All casting burrs shall be filed or ground flush with the surface of the casting.

3. Leaks and defects in pressure casings must not be repaired by plastic or cement compounds. When casting repairs are authorized by the material specifications, repair welding shall be according to the applicable ASTM specifications. Welding repairs shall be made with a welding rod that will give the same composition as the deposited material and of the same nominal chemical composition.

4. Cast iron materials are limited to a maximum design temperature of 121^0C .

4.2.14 Nameplates and Rotation Arrows

1. A corrosion-resistant nameplate shall be permanently attached to each pump. The nameplate shall be stamped with the following information.

   a.Equipment number

   b.Manufacturer's name

   c.Serial number of pump

   d.Model number of pump

   e.Rated capacity

   f. Pumping head

   g.Specific gravity of fluid

   h.Speed in RPM

   i. Driver rating.

2. Each pump shall be provided with a cast-in or permanently attached arrow indicating the direction of rotation.

5.0.0 SHOP INSPECTIONS AND TESTS

5.1.0 Test procedures and correction factors shall be agreed by purchaser and manufacturer. For this purpose detailed test procedure write up shall be submitted by manufacturer well in advance of test after placement of order. Typical calculations shall form part of the write up.

5.1.1 Nondestructive examinations shall be carried out according to the individual pump specification sheet. All results must be certified by the purchaser's inspector. Other requirements are as follows.

1. The magnetic particle method shall be used for superficial examination, if the material is ferromagnetic and the surface is accessible.

2. The liquid penetrant method shall be used for superficial examination, if the material is nonmagnetic or inaccessible for a magnetic particle examination.

3. The procedure and acceptance criteria (as per ASME, except as noted) for the various nondestructive examinations are:

Method	Procedure	Acceptance criteria
Welds		
Radiography	Sect V, Art 2	Sect VIII, Div 1
Magnetic particle	Sect V, Art 7	Sect VIII, Div 1, App VI
Liquid Penetrant	Sect V, Art 6	Sect VIII, Div 1, App VIII
Castings		
Radiography	ASTM E 94	MSS-SP-54
Magnetic Particle	Sect V, Art 7	Sect VIII, Div 1,App VII
Liquid Penetrant	Sect V, Art 6	Sect VIII, Div 1,App VII
Forgings		
Magnetic Particle	Sect V, Art 7	Sect III, NB-2545
Liquid Penetrant	Sect V, Art 6	Sect III, NB-2546
Ultrasonic	ASTM A 368	Sect VIII, Div 2, AM 203.2

5.2.0 HYDROSTATIC TEST

5.2.1 Each pressure casing shall be hydrostatically tested with water at 16^0C or above. The minimum test pressure shall be 1 1/2 times the maximum allowable casing working pressure.

5.2.2 Cooling water jackets shall be hydrostatically tested at a pressure of 1 1/2 times maximum cooling water system design pressure.

5.2.3 Auxiliary piping shall be hydrostatically tested with water at 16 ^{0}C or above. The minimum test pressure shall be 1 1/2 times the design pressure of the auxiliary piping or 8.0 Kg/cm^{2}G, whichever is greater.

5.2.4 All hydrostatic tests shall be maintained for a minimum of 30 minutes.

5.3.0 PERFORMANCE TEST

5.3.1 Each pump shall be performance tested with water and job motor. The purchaser's driver shall not be used for shop running tests if there is any possibility of serious overload.

5.3.2 Unless otherwise mutually agreed upon, the test speed of all pumps shall be the rated speed. Allowable deviations are as follows.

1. Normal fluctuations of motor speed.

2. Pumps manufactured for 50 Hz service may be tested at a standard 60 Hz speed and vice versa.

The certified test curve shall be corrected to actual speed of the job driver.

5.3.3 The performance test shall include a minimum of five test capacities extending from zero flow to at least 125% of capacity at peak efficiency. Capacity test points shall generally be equally

spaced and include one capacity not more than + 5% from rated capacity.

5.3.4 The complete pump assembly shall be guaranteed for head, capacity, power consumption and water NPSH at the specified rated operating conditions and satisfactory application to all operating conditions specified on the individual pump specification sheet.Permissible deviations from the specified performance (in percent of rated) are as follows or as otherwise specified in the specification.

Condition	Rated capacity		Zero capacity*	
	Plus	Minus	Plus	Minus
Rated differential head				
1. 0 to 150M	5	2	10	10
2. 151M & above	3	2	8	8
Power consumption (kW)	4	-	-	-
NPSH required	0	-	-	-
Guaranteed efficiency	-	0.5%	-	-

* A minus tolerance on the head-capacity curve at zero capacity (shut off) is allowed only if the continuously rising characteristic is maintained.

5.3.5 Each pump shall be checked for acceptable vibration during the shop performance test in accordance with subsection 4.2.4.

5.3.6 Mechanical seals shall be used during the shop performance test if so specified, but are not required for the hydrostatic test.

5.3.7 Pumps that are dismantled after the shop test solely to machine the impellers and achieve the tolerances for differential head need not be retested unless the reduction in impeller diameter exceeds 5 percent of the original diameter.

5.4.0 NPSH TEST

An NPSH test is required, if the difference between the NPSH available indicated on the pump specification sheet and the NPSH required by the pump is 1.0 metre or less.

6.0.0 ASSEMBLY & PREPARATION FOR SHIPMENT

6.1.0 GENERAL

Assembly and preparation for shipment shall be according to the pump manufacturer's standard and this specification. The pump manufacturer shall be solely responsible for packing and shipping the pumps.

6.2.0 EQUIPMENT TRAIN ASSEMBLY

6.2.1 Pumps, drivers and all furnished auxiliaries (except coupling spacers and bolts) shall be shipped fully assembled on the baseplates, except where it is not possible or advisable to ship the pump in fully assembled condition. Coupling spacers and bolts shall be separately boxed and securely attached to the base plate.

6.2.2 Metal filter elements and screens shall be cleaned and reinstalled prior to shipment.

6.3.0 PAINTING

6.3.1 Unpainted Surfaces

Stainless steel surfaces, interiors and finished surfaces such as flange faces, shafts and couplings, shall not be painted.

6.3.2 Painted Surfaces

The exteriors of pumps, drivers, baseplates, accessories and piping, except where otherwise prescribed in subsection 6.3.1., shall be painted before the equipment is shipped from the pump manufacturer's shop.

6.3.3 Painting shall be carried out under the following conditions.

a. Ambient temp. shall be above + 5^0C.

b. Relative humidity shall be below 80%.

c. Surface to be painted shall be dry.

6.3.4 Painting shall not be done during raining conditions.

6.3.5 Surface preparation is to be performed generally in accordance with SSPC standards so as to remove all rust, oil and foreign particle.

6.3.6 Painting shall be performed by spray gun.

6.3.7 Shop painting requirements.

Service conditions	Coat	Type of Paint	No. of coats	Dry Film Thk. (microns / Coat)
Extremely corrosive environment like splash & spillage of acids, urea upto 130 °C	Primer	Epoxy based red oxide	2	25
	Finish	High build epoxy based paint	2	35
Corrosive environment like exposure to salt dust, acid, acid fumes etc upto 65 °C	Primer	High build chlorinated zinc phosphate	2	25
	Finish	Chlorinated rubber paint	2	35
Corrosive environment like exposure to salt dust, acid, acid fumes etc 65 to 120 °C	Primer	Epoxy based red oxide / zinc chromate /zinc phosphate	2	25
	Finish	Epoxy based paint	2	35
Corrosive environment like exposure to salt dust, acid, acid fumes etc above 120^{0}C	Primer	-	2	35
	Finish	Silicon based paint	2	35
Ordinary environment upto 120 °C	Primer	Red oxide zinc chromate (IS2074)	2	25
	Finish	Synthetic enamel (IS2952)	2	35
Saline environment upto 125 °C	Primer	Epoxy based zinc chromate / zinc phosphate primer	2	25
	Finish	Epoxy based paint	2	35

6.3.8 Colour of finish paint for pumps and accessories shall be sea green shade No. 217 of IS-5. If any of the catogories of paint are not available in seagreen colour, then prime and finish coats can be given in avaiable colours. A final colouring coat of enamel paint in sea green colour shall be given over the finish coats in such cases.

6.3.9 Motors shall be painted as specified in motor spec.

6.4.0 Other Protection

6.4.1 Interiors

1. Bearings, bearing housings and oil systems shall be thoroughly cleaned and coated with a suitable rust preventive.
2. Surfaces that were in contact with fluids, including the stuffing boxes and flushing piping, shall be thoroughly dried. Surfaces that are susceptible to corrosion shall be coated with a suitable rust preventive.
3. Mechanical seal assemblies shall be fully protected from corrosion and ingress of foreign materials.

6.4.2 Exteriors

1. Unpainted exteriors, except stainless steel, but including bolting and flange faces, shall be coated with a suitable rust preventive.
2. Afterwards exposed shafts and shaft coupling shall be wrapped with waterproof moldable waxed cloth or VPI barrier paper. The seams shall be sealed with adhesive tape.

6.4.3 Openings

1. All threaded openings shall be plugged with long shank pipe plugs. The plug material shall be equivalent to the material being plugged, except that carbon steel plugs shall be used for openings in cast iron.
2. Flanged openings shall be provided with full flange diameter protective covers. The cover material shall be 4.5mm (minimum) thick metal plate. A full diameter gasket shall be supplied between the flange and the cover. The cover shall be secured to the flange by a minimum of four full diameter bolts and nuts.

6.5.0 Identification

6.5.1 Markings

1. Each major piece of equipment having an equipment number as per the purchase order or specification sheet shall have a permanently attached nameplate. The nameplate shall comply with the project specifications.
2. Connections furnished on the equipment shall be die-stamped or permanently tagged to agree with the pump manufacturer's connection table or general arrangement drawing.
3. Each coupling half and spacer shall be electrically etched or die-stamped with the equipment number of the pump for which it is intended.

6.5.2 Tags

1. Each pump component shall be identified by its purchase order number and equipment number. Tags shall be corrosion-resistant metal (not aluminum) and die- stamped with the purchase order number and equipment number.
2. Tags shall be attached to each pump component with stainless steel wire (The tags are in addition to the equipment nameplate). Equipments shipped in fully en closed containers shall also have the purchase order number and equipment number marked on the outside of the container.
3. Miscellaneous components shall be tagged or marked with the equipment number of the pump for which they are intended.
4. Equipment containing insulating oils, antifreeze solutions or other fluids shall be prominently tagged at openings to indicate the nature of the contents and shipping and storage precautions.

6.6.0 Packing

6.6.1 All equipment shall be packed, securely anchored (skid-mounted when required) and protected for domestic shipment by rail or truck. All unmounted components, except drivers, shall be suitably crated and firmly attached to the main pump unit for shipment. Export boxing, if required, shall be mutually agreed upon by purchaser and manufacturer.

6.6.2 One complete set of installation, operation and maintenance instructions shall be packed and shipped with the equipment, if required.

7.0.0 APPENDIXES

Appendix 1: Classification codes for Mechanical seals

Appendix 2: Piping for Seals

Appendix 3: Cooling Water Piping

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CONTENTS

1.0.0 SCOPE

1.1.0 This specification covers the general requirements for design, manufacture, testing and supply of medium voltage induction motors.

2.0.0 REFERENCE

2.1.0 The following documents shall be read in conjunction with this specification.
2.1.1 **Engineering specification and Data Sheet** of **General requirements for electrics**
2.1.2 **Data sheet** of **Medium Voltage Induction Motors**
2.1.3 **Technical particulars** of **Medium Voltage Induction Motors**

3.0.0 STANDARDS

3.1.0 All motors shall comply, wherever applicable, with the latest issues of the following Indian Standards and other relevant standards.

IS: 325	3 Phase Induction Motors
IS: 1231	Dimensions of 3 phase foot mounted Induction Motors
IS: 1271	Classification of insulating materials
IS/IEC60079-0	Electrical apparatus for explosive gas atmospheres: part 0-General requi rements
IS/IEC60079-1	Electrical apparatus for explosive gas atmospheres: part 1-Flame proof enc losures ”d”
IS/IEC60079-2	Electrical apparatus for explosive gas atmospheres: part 2-Pressurized enc losures ”p”
IS/IEC60079-7	Electrical apparatus for explosive gas atmospheres: part 7-Increased safety”e”
IS/IEC60079-15	Electrical apparatus for explosive gas atmospheres: part 15-construction test and marking for type of protection "n"
IS: 2223	Dimensions of flange mounted AC Induction Motors

IS: 2253	Designations for types of construction and mounting arrangements of rotating electrical machines
IS: 2254	Dimensions of vertical shaft motors for pumps
IS: 4029	Guide for testing three phase induction motors
IS: 4691	Degrees of protection provided by enclosure for rotating electrical machinery
IS: 4722	Rotating electrical machines
IS: 4728	Terminal markings and direction of rotation for rotating electrical machinery
IS: 4889	Methods of determination of efficiency of rotating electrical machines
IS: 6362	Designation of methods of cooling of rotating electrical machines
IS: 6381	Construction and testing of electrical apparatus with type of protection"e"
IS: 7389	Pressurized enclosures of electrical apparatus for use in explosive atmospheres
IS: 8789	Values of performance characteristics for 3 phase induction motors
IS: 12065	Permissible limits of noise levels for rotating electrical machines
IS: 12075	Mechanical vibration of rotating electrical machines with shaft heights from 56 & higher measurement, evaluation and limits of vibration severity
IS: 12615	Energy efficient motors

4.0.0 GENERAL REQUIREMENTS

4.1.0 All machines shall be continuous maximum rated (Class S1 as per IS:325) under the operating conditions specified in the data sheet, and shall be suitably protected for operation under the service conditions stated in data sheet.

4.2.0 Motors for hazardous areas shall be of a design for which approval has been obtained from the Central Mining and Research Institute (CMRI), Dhanbad, for use in the particular hazardous area specified. All motors approved as above, shall have a separate nameplate carrying the details of such approval, fixed on the body adjacent to the main nameplate. The approval / certification shall be latest/relevant.

4.3.0 The motor coupled to its driven machine shall start and operate successfully under full load even if the voltage at the motor terminals is lowered to 80% of rated voltage for 30 seconds.

4.4.0 Critical speeds should be either well below or well above the normal running speeds of the motor.

4.5.0 Slip at rated load shall not exceed 3% at rated voltage and frequency.

4.6.0 The motors shall be liberally designed as regards their pullout torque, pullout voltage and their ability to ride through voltage dips during system disturbances. They should, if required, be suitable for automatic restart under full load after a momentary lack of supply voltage, with the possibility of the restored supply voltage being out of phase with respect to the motor residual voltage. The extent to which the motor has to withstand out of phase residual voltage (in percentage) shall be as specified in the data sheet.

5.0.0 STARTING CURRENT AND TORQUE

5.1.0 All motors are envisaged to be started direct on line across full line voltage unless otherwise specified in the data sheet. The rotor shall be squirrel cage type unless otherwise specified in the data sheet. The rotor shall be dynamically balanced with fan and half key on the rotor shaft.

5.2.0 The starting characteristics of the machine shall be carefully selected as to:

5.2.1 Satisfy the torque requirements of driven machine, even where reduced voltage starting is specified in the data sheet.

5.2.2 Have starting time which is less than locked rotor withstand time (hot) of the motor by at least two seconds, at the rated conditions of voltage and frequency specified, with driven machine coupled.

5.2.3 Ensure that starting current is not normally more than 600% of full load current at the rated voltage and frequency (subject to IS tolerance) unless otherwise specified in the data sheet.

5.2.4 Ensure that accelerating torque is not too large to cause stressing of the transmission elements and the driven machine

5.2.5 Ensure that motor is suitable for starting at 80% of the rated voltage against torque speed characteristics of the driven equipment.

6.0.0 NUMBER OF STARTS

6.1.0 The motor shall be suitable for the number of starts specified in the data sheet. If nothing is specified in data sheet, then the motor should be suitable for Direct-on-line starting with minimum number of starts stated below:
a) Three successive cold starts
b) Two successive hot starts
c) Four uniformly spaced starts per hour

7.0.0 INSULATION

7.1.0 Insulation class shall be class F with temperature rise limited to class B

7.2.0 Motor winding shall be done using copper conductor only

7.3.0 The winding shall be tropicalised.

7.4.0 All windings shall be treated with humidity, acid and alkali resisting protective coating like epoxy gel to withstand service conditions in an industrial atmosphere described in data sheet.

8.0.0 CONSTRUCTION

8.1.0 The motor shall be able to withstand the corrosive atmosphere mentioned in data sheet. External screws and bolts shall be protected particularly against corrosion by passivation.

8.2.0 The enclosure shall be provided with the required degree of protection, viz IP 55 (Indoor) / IPW55 (Outdoor) / Flameproof / Flameproof weatherproof, etc. as specified in the data sheet.

8.3.0 Vibration and noise levels shall not exceed those given in the relevant IS.

8.4.0 Motor frame sizes shall be in accordance with IEC recommendation in the absence of Indian Standards. For a particular motor, required frame sizes as per IS / IEC or higher frame size shall only be supplied.

8.5.0 The shaft shall be generously proportioned for transmitting continuous full load torque and any specified overload or duty, which may be created by the driven machine. In designing the motor shaft and bearing systems, the manufacturer shall take full account of the characteristics, thrust, shaft system and bearing system of the driven machine and also the type of coupling proposed, so as to give a completely satisfactory shaft and bearing system.

8.6.0 The motors shall be suitable for connecting capacitor at the motor terminals, if required in data sheet. Rating of capacitor shall be as indicated in the data sheet. If there is any limitation/ inadequacy with regard to the rating of the capacitor that can be connected to the motor, the findings shall be clearly substantiated in the Technical Particulars.

8.7.0 Condensate drains shall be provided where water may collect. Drain holes shall also be provided, wherever required.

8.8.0 Foundation rails if any, foundation bolts, nuts; washers, etc. shall be supplied.

8.9.0 All motors shall be capable of standing idle for long periods without damage to the bearings.

9.0.0 VENTILATION

9.1.0 Motors shall be self-ventilated.

9.2.0 Materials of construction of fans, tubes, etc. used shall be suitable for the environment specified in the data sheet.

9.3.0 Motors shall be bi-directional, i.e. suitable for rotation in clockwise and anti-clockwise directions.

10.0.0 BEARINGS AND LUBRICATION

10.1.0 The bearings shall be of reputed manufacturer and of a type interchangeable with bearings from other makes.

10.2.0 The method and type of lubrication shall be selected by the manufacturer and shall be suitable for the rating (kW), speed and duty involved.

10.3.0 Excess grease escape devices shall be provided.

10.4.0 Grease migration to winding shall be prevented.

10.5.0 Necessary grease nipples for online lubrication from outside shall be provided for both Drive End and Non-Drive End bearings. Whenever grease nipples are provided, these shall be associated, where necessary, with appropriately located relief devices to ensure passage of grease through the bearings.

10.6.0 Name and grade of lubricant shall be given in the motor nameplate.

10.7.0 Lubrication schedule for the motors shall be indicated in the nameplate or shall be furnished separately in the maintenance manual.

10.8.0 Details of bearing shall be furnished in the test certificates, to facilitate ordering of spares.

11.0.0 WEATHERPROOFING

11.1.0 If Outdoor service is specified in the data sheet, the motors shall be suitable for operation in direct sun and rain, without further protection (like canopy, hood, etc.) from weather. However, vertical motors shall be provided with a hood over the fan cover, as an integral part of the motor.

12.0.0 TERMINAL BOXES AND TERMINATIONS

12.1.0 The motors shall be complete with compression type cable glands suitable for the armoured PVC /XLPE main power cables, as specified in the data sheet.

12.2.0 All the six winding ends shall be brought out and marked to one terminal box for power supply connections.

12.3.0 The terminal boxes shall be suitable for the system fault level for 0.25 seconds or as indicated in data sheet. The terminal boxes shall be amply sized to accommodate the cable sizes specified in data sheet. The terminal box shall be provided with pressure relief device if necessary.

12.4.0 It shall be possible to rotate the terminal box in steps of 90 degrees to enable cable entry from any direction.

12.5.0 Live terminals shall be insulated from the frame with material resistant to tracking.

12.6.0 Flameproof double compression type cable glands shall be provided for flameproof motors approved by CMRI, Dhanbad.

12.7.0 For anti-condensation heater, thermistor, etc. separate terminal boxes shall be provided, with cable glands, suitable for the cable sizes specified in data sheet. These terminal boxes shall be flame proof for flameproof motors.

12.8.0 Main terminal box shall be located on the right hand side of the motor, when viewed form its drive end, unless otherwise specified in the data sheet.

12.9.0 In case star delta starting is envisaged / capacitors are to be connected to the motor terminals, the terminal box shall be of special design by which sufficient creepage space between terminals is available. The terminal box shall be provided with two / three sets of cable glands as specified in the Data Sheet.

13.0.0 EARTHING

13.1.0 All motors shall have two suitable earth studs, capable of withstanding the fault level, integral to the motor frame for motor earthing. The studs should be adequate for accepting lug of the earthing conductor size specified in the data sheet.

14.0.0 NAME PLATES

14.1.0 Two stainless steel nameplates shall be supplied and fastened by SS fasteners. In addition to the data required to be furnished on the name plate as per IS, locked rotor current, temperature rise, type of enclosure, direction of rotation (if unidirectional), weight, grade of lubricant, bearing sizes and ambient temperature for which the motor is designed shall also be indicated.

14.2.0 A stainless steel warning label with indelible red inscription shall be provided on the motor to indicate that isolation of main power supply alone is not sufficient and that space heater supply shall also be isolated before carrying out any work on the motor.

15.0.0 LIFTING FACILITIES

15.1.0 Provision for lifting the motor shall be provided on the motor.

16.0.0 COUPLINGS

16.1.0 The motor shall be supplied with bare, single shaft extension and key. The couplings shall be supplied and fitted by the driven machine supplier.

17.0.0 ANTICONDENSATION HEATERS

17.1.0 The motors of rating 37 KW and above shall be provided with anti condensation heaters to prevent condensation when the motor is kept idle for long periods. The anti-condensation heaters shall be rated for single phase 240 V, 50 Hz. power supply, unless otherwise specified in the data sheet.

18.0.0 PROTECTION

18.1.0 Embedded temperature detectors or thermistors, hot air thermostats, etc. shall be provided in the motor if specified in the data sheet. Where thermistors are provided, thermistor control relay shall be supplied loose in a suitable weatherproof enclosure of cast aluminium.

19.0.0 RECIPROCATING COMPRESSOR FACTOR

19.1.0 Supplier of motors for driving reciprocating compressors shall liaise with the purchaser and the compressor manufacturer to ensure that the compressor factor chosen is sufficient to have a satisfactory degree of current pulsations.

20.0.0 MOTOR SUPPLIED ALONG WITH THE DRIVEN MACHINE

20.1.0 When a motor is supplied as a combined unit with the driven machine, the driven machine supplier shall ensure proper co ordination in the selection of motor and its characteristics. The driven machine supplier is also responsible for the suitability of the motor for the equipment and shall guarantee a reasonable defect liability period.

20.2.0 The driven machine supplier shall also ensure the correctness of the motor test certificates, suitability of couplings etc.

21.0.0 ADDITIONAL ACCESSORIES / REQUIREMENTS

21.1.0 The motors shall be provided with additional accessories / requirements, if any, specified in the data sheet

21.2.0 Where any special requirement such as degree of protection to enclosures, thermal cutout, special cable boxes, extra starting torque, supply of half coupling, etc. are specified, these details shall be clearly recorded in the test certificates or in an attached supplement.

22.0.0 DESPATCH

22.1.0 Before despatch, opening in the motor like cable entry should be sealed to prevent entry of moisture and dust during transit and storage.

CONTENTS

1.0.0 SCOPE

1.1.0 This specification covers the general requirements for supply and installation of all electrical items as applicable.

2.0.0 REFERENCE

2.1.0 The following documents shall be read in conjunction with this specification:

2.1.1 Data sheet of General Requirements for Electrics.

2.1.2 Engineering specifications, Data sheets and Technical Particulars of individual equipment / items.

2.1.3 Scope of work, Scope of Inspection and Tests, Special requirements of the project, Vendor Data Requirements, etc attached with the Technical Procurement Specifications.

3.0.0 COMPLETENESS OF CONTRACT

3.1.0 The electrics supplied / installed shall be complete with all accessories for the safe, smooth and efficient operation of the system. Such parts shall be deemed to be within the scope of this specification whether specifically mentioned or not.

4.0.0 COMPONENTS AND CONSTRUCTION

4.1.0 Each and every component shall be of reputed make and be of proven design for best performance, reliability and durability. They shall be brand new. Workman ship shall be of the highest grade and the entire construction shall be in accordance with the best modern engineering practice.

5.0.0 STANDARDS & REGULATIONS

5.1.0 All electrical equipment / installations shall fully comply with the requirements laid down in the following rules / regulations / acts / standards / codes as amended up to date.

5.1.1 Indian Electricity Rules.

5.1.2 Indian Electricity Act.

5.1.3 Indian Electricity Supply Act.

5.1.4 Indian Factories Act.

5.1.5 Fire Insurance Act.

5.1.6 Petroleum Rules.

5.1.7 OISD Standards.

5.1.8 Pollution control norms as per Environmental Regulations.

5.1.9 Standards / regulations of statutory bodies applicable for the place of installation.

5.1.10 Relevant Indian / International standards and in their absence, the standards of the country of manufacture.

5.2.0 Vendor shall furnish all necessary assistance & documents for obtaining approval from statutory bodies. Making whatever additions/ modifications considered necessary by the Electrical Inspectorate and other authorities to bring the equipment / installation in conformity with the above rules, Regulations, acts and standards shall be in the scope of the vendor.

5.3.0 All equipment shall be of tropical design according to relevant Indian / International Standards.

5.4.0 All electrics shall be suitable for the hazardous / non-hazardous area involved and /or specified. Electrics suitable for the hazardous area involved shall be selected as per the relevant Indian Standards and shall be of proven design approved by CIMFR / relevant statutory bodies. In such cases copies of relevant certificates shall be furnished for Purchaser's approval.

6.0.0 SERVICE CONDITIONS

6.1.0 All equipment shall be suitable for the service conditions specified in the **Data sheet of General Requirements for Electrics** attached.

7.0.0 EARTHING

7.1.0 Duplicate earthing terminals, suitable for terminating earthing conductors of sizes indicated in the data sheets of individual equipment, shall be provided on the body of the equipment apart from those, if any, provided inside the terminal boxes.

8.0.0 POWER SUPPLY DETAILS

8.1.0 The equipment shall be suitable for the power system details furnished in the **Data sheet** of **General Requirements for Electrics** unless otherwise specified in the data sheets of individual equipment.

8.2.0 The equipment shall perform satisfactorily even with variation in supply voltage and frequency as detailed in the data sheets. The equipment shall operate at the specified rating without exceeding the permissible temperature rise as per the relevant I.S. in spite of the variation in supply voltage and frequency.

9.0.0 NAME PLATES

9.1.0 Necessary nameplates, conforming to standards, giving relevant details of the equipment, shall be provided on individual equipment. Any additional details shall also be indicated in the nameplate, if so specified in the specifications / data sheets of individual equipment.

10.0.0 PAINTING

10.1.0 Unless otherwise specified in the specifications / data sheets of individual equipment / items, painting procedure described in this clause shall be adopted.

10.2.0 All exposed metal parts shall be subjected to at least the following pretreatment before painting to suit the material and environment involved.

10.2.1 De-greasing.

10.2.2 Rust removing.

10.2.3 Phosphating/ equivalent chemical treatment.

10.2.4 Giving two coats of corrosion resistant primer suitable for final coating.

10.3.0 Two coats of anticorrosive painting shall be given after the above process so as to render the materials suitable for the highly corrosive environment specified.

10.4.0 Final Colour and finish of the equipment shall be Dark Admiralty Grey (shade no: 632) as per IS: 5 unless otherwise specified in the data sheet for individual equipment/item.

10.5.0 Vendor shall furnish detailed painting procedure proposed, along with the bid.

11.0.0 INTER-CHANGEABILITY

11.1.0 All similar parts shall be inter-changeable with each other.

12.0.0 DANGER NOTICE PLATES

12.1.0 Danger Notice plates conforming to IS: 2551 and other statutory requirements shall be affixed on equipment wherever required.

13.0.0 TOOLS AND APPLIANCES

13.1.0 The vendor shall supply one set of special tools and appliances that may be required for carrying out the maintenance, special inspection etc. of the equipment offered, without any extra cost.

13.2.0 Vendor shall also furnish list of tools and appliances required for the maintenance of different equipments.

14.0.0 SERVICES OF MANUFACTURERS' TECHNICAL EXPERTS

14.1.0 Services of the manufacturer's technical experts shall be made available to the Purchaser, if found necessary, during erection, testing, and commissioning and during the guarantee period.

15.0.0 TRAINING

15.1.0 The vendor shall render all facilities free of cost for imparting training to purchaser's technical personnel at manufacturer's works, if required, for the proper assembly, installation, testing, commissioning, operation and maintenance of the equipment supplied. The travel and living expenses of the personnel deputed for training will be borne by the Purchaser.

16.0.0 PERFORMANCE OF EQUIPMENT

16.1.0 Duly filled in **Technical Particulars** of individual equipment / item shall be furnished as per formats attached. Performance figures of the equipment as per **Technical Particulars** furnished along with the offer shall be guaranteed.

17.0.0 TESTS

17.1.0 All the tests specified in **Scope of Inspection & Tests** attached along with the **Technical Procurement Specification** shall be performed.

18.0.0 DOCUMENTS

18.1.0 Drawings and documents shall be furnished as per **Vendor Data Requirements (VDR)** attached with **Technical Procurement Specification.**

19.0.0 INSTRUCTIONS TO THE BIDDER

19.1.0 All the drawings and documents as per Vendor Data Requirements shall be furnished along with the offer. Offers without these details will be treated as incomplete and are liable for rejection.

19.2.0 In the absence of clearly spelt-out item wise deviations from purchaser's specification, it will be presumed that the equipment offered are in conformity with the specification.

19.3.0 The Vendor shall supply all equipments and items of make specified in the vendor list attached with the specification. The Vendor shall obtain Purchaser's approval before placement of purchase order for electrical items / components wherever makes are not specified in the respective data sheets.

MPCE DEPARTMENT	SCHEDULE OF ITEMS OF WORK	32644-02-PS-002 SIW	
		PAGE 1 OF 2	R 0

PROJECT: CONSTRUCTION OF PHOSPHORIC ACID STORAGE TANKS AND ASSOCIATED FACILITIES AT Q10 BERTH, WI.	CUSTOMER: FACT-CD	LOCATION: W. ISLAND	PROJECT NO: -32644

Sl. No	Description of Item	Unit	Quantity	Rate, Rs		Amount Rs.
				in Fig.	in Words	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.0	**PHOSPHORIC ACID TRANSFER PUMPS (P-3202A/B)** Design, Detailed Engineering, Preparation and approval of drawings & documents, fabrication, assembly, Pre Inspection meeting at Vendor/Supplier shop, Stage wise inspection and testing, Surface preparation & Painting, inspection and testing, Supply of all materials, spares (including all accessories), Packaging & Forwarding, factory acceptance test (FAT) and submission of production test certificate of Horizontal Centrifugal **Phosphoric Acid Transfer Pumps P-3202A/B (Capacity 175 M^3/Hr, Discharge pressure 4.0 Kg/cm^2G and MOC CD4MCu)** with Electric drive motor, with the operating parameters specified in data sheet and as per the technical requirements furnished along with the tender document.	Nos.	2			
2.0	**PHOSPHORIC ACID SUMP PUMP (P-3203 A/B)** Design, Detailed Engineering, Preparation and approval of drawings & documents, fabrication, assembly, Pre Inspection meeting at Vendor/Supplier shop, Stage wise inspection and testing, Surface preparation & Painting, inspection and testing, Supply of all materials, spares (including all accessories), Packaging & Forwarding, factory acceptance test (FAT) and submission of production test certificate of Vertical Centrifugal **Phosphoric Acid Sump Pump, P-3203 A/B (Capacity 25 M^3/Hr, Discharge pressure 4.4Kg/cm^2G and MOC CD4MCu)** with Electric drive motor, with the operating parameters specified in data sheet and as per the technical requirements furnished along with the tender document.	No.	2			
3.0	**RAIN WATER PIT PUMP (P-3204)** Design, Detailed Engineering, Preparation and approval of drawings & documents, fabrication, assembly, Pre Inspection meeting at Vendor/Supplier shop, Stage wise inspection and testing, Surface preparation & Painting, inspection and testing, Supply of all materials, spares (including all accessories), Packaging & Forwarding, factory acceptance test (FAT) and submission of production test certificate of Horizontal Centrifugal **Rain Water Pit Pump, P-3204 (Capacity 25 M3/Hr, Discharge pressure 1.0 Kg/cm2G and MOC CD4MCu)** with Electric drive motor, with the operating parameters specified in data sheet and as per the technical requirements furnished along with the tender document	No.	1			

REV	DATE	PRPD	CHKD	APPRD
0	17-02-2021	IA	SK	AAN

FACT ENGINEERING AND DESIGN ORGANISATION

FEDO

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MPCE DEPARTMENT	SCHEDULE OF ITEMS OF WORK	32644-02-PS-002 SIW	
		PAGE 2 OF 2	R 0

PROJECT: CONSTRUCTION OF PHOSPHORIC ACID STORAGE TANKS AND ASSOCIATED FACILITIES AT Q10 BERTH, WI.	CUSTOMER: FACT-CD	LOCATION: W. ISLAND	PROJECT NO: -

Sl. No	Description of Item	Unit	Quantity	Rate, Rs		Amount Rs.
				in Fig.	in Words	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
4.0	**MANDATORY SPARES**	**SHALL BE QUOTED SEPARATELY AS PER THE ATTACHED FORMAT**				
5.0	**SPARES FOR 2 YEAR NORMAL OPERATION**	**SHALL BE QUOTED SEPARATELY AS PER THE ATTACHED FORMAT**				
6.0	**SUPERVISORY SERVICES** Supervisory services for Erection, Site Acceptance Test/PGTR, & Commissioning	**PER DIEM RATES SHALL BE QUOTED FOR ENGINEER & TECHNICIAN SEPARATELY**				
	GST % of Rs.	**Final Lump sum Price :**				**INR**

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