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#### Date: 05/02/2025

# **Clarification No. (3)**

Project:	Water Security and Resilience Program (SoP1)
Contract Title:	Construction of Water Transmission Pipelines between Salem and
	Al Jalameh and Main Booster Pump Station
RFB No.:	PWA/WSRP/W01/RFB
Invitation No.:	PWA/WB/2024/018-CTD

**Reference is made to the BDS, Section I – Instruction to Bidders (ITB), Clause 7. Clarification of Bidding Document.** 

#### **Questions and Responses:**

# Q.1 Motor Rated Power – PART 2, SECTION VIIC MECHANICAL SPECIFICATIONS, Section 11140 Rev. 01, Page 2/10

JALAMEH	I AND MAIN	BOOSTEF	R PUMP	STATION		WEEN G.													Section 11
								Main	Pumping	g Booste	er Statio	n							
BPS Name	Tag	FI	ow at 20 (m <sup>3</sup> /hr)	120	Flow at 2040 (m <sup>3</sup> /hr)			Each Pump Flow (m <sup>3</sup> /hr)					Rated Head	Motor Rated Power		Pump Components Sizes (mm)			
		Min.	Avg.	Max.	Min.	Avg.	Max.	Min. 2020	Min. 2040	Duty 2020	Duty 2040	Rated	(m)	ĸw	hp	Column	Can	Can Inlet	Discharge Head
Main Booster Btation MBPS	MBPS 001, 002, 003, 004, 005	694.0	694.0	832.8	688.1	688.1	825.7	231	229	231	229	231	295	335	450	250	600	300	250
otal pump utlet as sh	and barrel	lengths a sign draw	ire as pe	r approve	d manuf	acturer a	and shall o	comply w	ith the m	ninimum	required	vertical dis	stance bet	veen th	e cente	rlines of can	inlet and	l pump d	ischarge head
lated head	d for all pun	nps is me	asured a	t the pum	p's bowl														
he pump 5% at lea:	rated flow s st, the pum	hall be se	elected w s shall be	ithin 80% e 4 pole (1	to 110% 1500 rpm	of the p ), IEC 3	oump's BE efficiency	EP flow, t / class.	he shut-	off head	shall be	between 1	20% to 15	)% of ra	ted hea	id, the bowl e	efficiency	y of the p	umps shall be
ump hydr	aulic perfor	mance sh	all be ac	cording to	o ISO 99	06: 2012	2 (ANSI-H	I 14.6)- (	Grade 1U	J.									
ated Hou	rly Flow for flow (1.2 Ho	Main Boo	ster Sta	tion is ass 20 hours	signed a	gainst th	e average	e daily flo	w (1.0: F	lourly Pe	eak Facto	or (24 hour	/day), how	ever an	additio	nal pump wil	l be on o	luty whe	n pumping the

#### 1. ANSI/HI 2.6-2000 Vertical Pump Tests Efficiency Calculation:

2.6.5.8.7.1 Calculation of bowl assembly efficiency ( $\eta_{ba}$ ) This efficiency value excludes all losses outside the bowl assembly proper: (Metric units)  $\eta_{ba} = \frac{Q \times H_{ba} \times s}{366 \times P_{ba}} \times 100$ 

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Q – Flow Rate (m<sup>3</sup>/h) H<sub>ba</sub> – Bowl Assembly Total Head (m) S – Liquid Specific Gravity P<sub>ba</sub> – Bowl Assembly Absorbed Power (kW)

Absorbed Power Calculation:

 $\mathbf{P} = \frac{Q \times H \times s \times 100}{\eta \times 366}$ 

- 2. According to the specification, the efficiency should be  $\geq$  75% with Tolerance Grade 1U.
- 3. Therefore, the absorbed power at the Rated Point is calculated as follows:

 $P = \frac{231 \times 295 \times 1 \times 100}{75 \times 366} = 248 \text{ kW}$ 

4. Given that the pump (rather than the bowl assembly) absorbed power is 3% higher, and applying a Grade 1U tolerance of +10%, the rated motor power is calculated as:

 $248 \times 1.03 \times 1.1 = 281$  kW.

5. If the bowl assembly efficiency is 80%, the pump absorbed power is approximately 255 kW, with a 1U tolerance margin.

#### **Bidder's Recommendation:**

We suggest providing the motor with a rated power that corresponds to the pump's requirements and is based on the available frame sizes, rather than the specified 335 kW.

A. No change to the project's requirements and specifications. Specified Motor rated power remains unchanged

# Q.2 Suction Can Diameter – PART 2, SECTION VIIC MECHANICAL SPECIFICATIONS, Section 11140 Rev. 01, Page 2/10

WATER AUTHORITY





BPS Name	Tag	Flow at 2020 (m³/hr)			Flow at 2040 (m³/hr)			Each Pump Flow (m <sup>3</sup> /hr)					Rated Head	Motor Rated Power		Pump Components Sizes (mm)			
		Min.	Avg.	Max.	Min.	Avg.	Max.	Min. 2020	Min. 2040	Duty 2020	Duty 2040	Rated	(m)	ĸw	hp	Column	Can	Can Inlet	Discharge Head
Main Booster Station MBPS	MBPS 001, 002, 003, 004, 005	694.0	694.0	832.8	688.1	688.1	825.7	231	229	231	229	231	295	335	450	250	600	300	250
Fotal pump outlet as sh	and barre	l lengths a sign draw	re as pe ings.	r approve	d manuf	acturer a	ind shall o	comply w	ith the m	inimum	required	vertical dis	stance betw	ween th	e cente	rlines of can	inlet and	pump d	ischarge head
Rated head The pump 75% at leas	d for all pur rated flow ៖ st, the pum	nps is mea shall be se ps' motors	asured a lected w s shall be	t the pum ithin 80% e 4 pole (1	p's bowl. to 110% 500 rpm	of the p ), IEC 3	ump's BE efficiency	P flow, t class.	he shut-	off head	shall be	between 1	20% to 150	0% of ra	ited hea	ad, the bowl e	efficiency	of the p	umps shall be

1. ANSI/HI 9.8 – 2018 Rotodynamic Pumps for Pump Intake Design Flow Velocity requirements:



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2. The flow velocity calculation is as follows:

 $A(m/sec) = \frac{Q(m^3/h)}{2826 \times (D^2 can(m) - D^2 pump(m))}$ 

3. Given that a typical pump with a BEP around 230 m<sup>3</sup>/h has a maximum external diameter  $\leq$  310 mm, the suction can internal diameter (ID) needed to maintain a flow velocity around 0.8 m/sec is 450 mm.

#### **Bidder's Recommendation:**

We suggest providing the suction can with a diameter that ensures a flow velocity between 0.8 - 1 m/sec between the can and the pump, rather than the specified 600 mm

A. No change to the project's requirements and specifications. Specified can inlet diameter remains unchanged

#### Q. 3 Motor Type:

1. Clause 2.6 specifies that the motor must be of a hollow shaft type, allowing for its removal without disturbing the pump.

#### 2.6 DRIVE UNITS

#### Electric Motors.

Electric motors shall be designed as specified in the Common Motor Requirements for Process Equipment section 16220. Motor shaft shall be hollow shaft. An adjustable coupling designed for vertical pump service shall be provided between each shaft motor and the shafting to permit removal of the motor without disturbing the pump. The coupling be keyed to the shafts and shall provide for vertical adjustment of the impeller with the motor in place.

2. Clause 2.5 requires the pump to be furnished with an anti-reverse ratchet assembly and vibration sensors at the pump bearing housing.

#### 2.5 ACCESSORIES

- Anti-Reverse Device. Provide a non-reverse ratchet.
- Vibration Protection. Pump vendor shall include bi-axial sensors (Vibration transducer) for each Pump-Shaft-Motor Assembly. The vibration sensor shall be threaded type, installed into prethreaded locations at the pump upper bearing locations.

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- 3. The requirements listed above conflict with the fundamental characteristics of hollow shaft motors, which are more suitable for solid shaft motors.
  - A hollow shaft motor does, in fact, "disturb" the pump and mechanical seal during disassembly, as the motor thrust bearings are responsible for holding the pump shaft in its adjusted (lifted) position. When uncoupled, the motor shaft disconnects, causing the pump shaft to drop and requiring partial disassembly of the mechanical seal.
  - The pump designed for a hollow shaft motor does not include an anti-reverse ratchet or top bearings.
- 4. The characteristics of a solid shaft motor are more aligned with the booster pump application:
  - A bottom radial bearing minimizes motor shaft runout, which is critical for the mechanical seal.
  - "Plug & Play" installation with a flexible pin-and-bush coupling allows for easier and quicker disassembly and reassembly, unlike the hollow shaft motor, which requires highly skilled personnel and specialized tooling.
  - IP55 protection, which is superior to the NEMA TEFC (IP54) rating found in hollow shaft motors.
  - Interchangeability with IEC motors from any brand or manufacturer, as opposed to the hollow shaft motor, which is only interchangeable with the same type, size, and brand.
  - The pump designed for a solid shaft motor incorporates both the anti-reverse ratchet assembly and top thrust bearing housing, protected by vibration sensors and temperature monitoring.

#### **Bidder's Recommendation:**

We suggest revising the specification to either require a solid shaft motor or allow for both motor types to meet the application requirements.

A. No change to the project's requirements and specifications. Specified shaft type remains unchanged

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#### Q.4. Motor Protections – PART 2, SECTION VIID ELECTRICAL WORKS SPECIFICATIONS, Section 16220 Rev. 01

1. Clause 2.2.12 refers to temperature sensing devices.

# 2.2.12 Temperature Sensing Devices Motors shall be equipped with one of the following features, refer to project design drawings for specific type required. 1. Provide winding thermostats where indicated on the drawings, winding thermostats shall be snap action, bi-metallic, temperature-actuated switch. Thermostats shall be provided with one normally closed contact. The thermostat switch point shall be pre-calibrated by the manufacturer. 2. Each motor controlled by an adjustable frequency drive shall be furnished with at least one automatic reset winding temperature switch per phase. Temperature switch contacts shall be normally closed and rated 5 amps at 120 volts ac. The contacts shall be wired in series with the end leads brought out to the motor terminal box. 3. Where Indicated on the drawings and/or, motors shall be furnished with a pair of resistive temperature devices (RTDs) placed in each phase winding to sense winding temperature.

**Bidder's Clarification:** 

It is unclear whether the motors should be equipped with thermistors (PTC), RTDs (PT100), or both. Could you please clarify this requirement?

A. Motors are complete with winding and lower/upper bearing RTDs.

Bidder shall also refer to PID drawings and electrical specifications section 13500-Main Booster Pump Station Instruments, Devices and Signals List.

2. Clause 2.6 Radial Shaft Vibration Transducers:

#### 2.6 Radial Shaft Vibration Transducers

Whether as indicated on project drawings, with sleeve bearings, provide vibration sensors, signal converter (24Vdc) with display and 4- 20ma output for remote readout.

Vibration Sensor and RTD's should be connected to indoor enclosed Graphic Data Manager and recorder display (GMR) per section16010 from which a communication signal to be connected to PLC for display readings and to VFD Driver for alarm and shutdown unless otherwise noted.

The vibration transducers shall be provided and permanently installed by the motor manufacturer. The vibration transducers and timing transducer shall be prewired to a terminal junction box mounted on the motor base next to the RTD terminal box.

#### **Bidder's Clarification:**

It is unclear whether the motors should be equipped with vibration sensors. Could you please confirm if this requirement is included?

A. Motors are complete with vibration transducers. Bidder shall also refer to PID drawings and electrical specifications section 13500- Main Booster Pump Station Instruments , Devices and Signals List

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Q. 5. As per specs 13205 (Surge Tanks) 2.2- Design Criteria, Tank Type: Vertical cylinder with seamless ellipsoidal or torispherical ends. however, in the drawing the tank is horizontal. kindly advise.

A. The tank is horizontal as per drawings and schedule. All other specifications and features remain unchanged

#### Q. 6. Finally, regarding the answers in Clarification2:

#### 1. Extension stems length is not clear in the drawings

A. Refer to our previous response- Clarification No.2 - Answer to Question 16.

The bidder shall estimate the length of stems based on cross sectional drawings of the miscellaneous valves. However, the exact length shall be identified by the contractor based on approved shop drawings/materials

# **2.** Still we have no information if we can offer ductile iron valves PN16 instead of bronze or Brass

A. No change to the project's requirements and specifications. The Bidder shall select the valve type based on the Schedule of Valves and in accordance to the project's specifications.

Furthermore, Bronze/brass body valves (Code GV-01) shall be provided if mentioned in the Schedule of valves (Refer to drawings H-1101-J-003 & 004).

#### 3. For the EM flow meter please clarify the below:

PN rate?, Battery or powered?, Compact or separate?,

**Outputs options:** 

Pulse

4-20MA

#### Modbus

A. For EM flow meters, bidder shall refer to:

- Schedule of Flow Monitoring -Drawing: H-1101-J-001 and PID drawings.
- Electrical Specifications-Sections 13562 13500- Main Booster Pump Station Instruments, Devices and Signals List.
- Meters of separate transmitter type.

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Q. 7. Please advise if there is any problem if the contractor submits a bid for the package 1 as main contractor and for the package 2&3 as JV OR subcontractor?

A. The bidder can participate in more than one package. However, the evaluation and the award methodology and process will consider the fulfillment of the requirements for each individual package, as well as for any combined packages, in accordance with the stipulations set forth in the bidding documents and any clarifications provided.