Base Load Power Hub (BLPH)

FAT (FINAL ACCEPTANCE TEST) PROCEDURES
For Sea Water Lift Progressive Cavity Pumps (P-50001 A/B)

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Revision / Change Log

Rev.	Description
00	Issue for Review (IFR)
01	Accepted for Construction (AFC)
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1	
2	
3	
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Table of contents

1 Document Scope 4
2 Reference Documents 4
3 General 4
4 Mechanical Run Test 5
4.1 Description 5
4.2 Acceptance criteria 5
5 Performance Test 6
5.1 Description 6
5.2 Acceptance criteria at rated pressure 6
6 Vibration test 7
6.1 Description 7
6.2 Acceptance criteria 7
7 Noise Test 8
7.1 Description 8
7.2 Acceptance criteria 8
8 Dimensional check, Visual Inspection & Nameplates check 8
9 FAT Configuration 9
10 APPENDIX – Report Template 10

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1 DOCUMENT SCOPE

This procedure aims at describing final acceptance tests to be performed on Sea Water Lift Progressive Cavity Pumps (P-50001 A/B) including Mechanical Run, Performance, Noise & Vibration tests.

2 REFERENCE DOCUMENTS

- General Arrangement Drawing // 1724000936-MAC-DA-00004
- Pump data sheet // 1724000936-MAC-DS-00012
- Inspection and Test Plan // 1724000936-QC-ITP-00002
- Performance curves for equipment and auxiliaries // 1724000936-MAC-DS-00015
- Positive Displacement – Pumps Rotary // API STANDARD 676 THIRD EDITION

3 ABBREVIATION

- FAT: Factory Acceptance Test
- API: American Petroleum Institute
- SPL: Sound pressure level
- PSV: Pressure Safety Valve
- RMS: Root Mean Square

4 GENERAL

FAT will be achieved in accordance with above project documentation in "Complete Unit" configuration with job Motor (PM-50001 A/B) & API plan 51. The test is performed with water (Chloride content below 50ppm) which will be set between 10°C & 30°C (Target 20°C). The test will be performed at 400 V – 50Hz.

The FAT will be composed of the following tests:

- Mechanical run test (Section 2)
- Performance test (Section 3)
- Vibration measurement (Section 4)
- Global noise measurement test (SPL @1m) (Section 5)
- Dimensional, visual & nameplates checks. (Section 6)

Readings are according to the accuracy of the measuring instruments used. Instruments are chosen to have measures between 20% and 80% of the scale of measures. These instruments are identified

and regularly controlled. Valid calibration certificates for measurement devices will be provided during FAT and attached to FAT report.

Here is the list of instruments to be used during FAT:

- Manometer to record discharge pressure,
- Flowmeter to record flow rate,
- Thermometer to record water, bearing & gearbox temperature,
- Speedometer to record pump rotation speed,
- Multimeter to record Voltage, Intensity, frequency & power consumption.

5 MECHANICAL RUN TEST

5.1 DESCRIPTION

This test consists of a run test of 1 hour at rated speed and rated differential pressure. The following parameter will be recorded every 30 minutes (3 points in total): flow rate, Gearbox & Bearing skin temperature, water temperatures, differential pressure, pump speed, voltage, intensity, and power consumption of the motor.

Due to PCM well depth of 20/21 meters, Pumps will be assembled in short test configuration by removing 4 casing extension (12m) for a total length of 18m below mounting flange. Note that discharge pressure will be corrected to take into consideration the pump's sections removed. As we have 12m removed, Discharge pressure will be increased by 1.2bar.

Notes:

- Due to motor load, speed could be slightly different to pump datasheet,
- It is assumed that the suction pressure is equal to the atmospheric pressure, and the discharge pressure is equal to the differential pressure using water at "rated" temperature. (test configuration – section 9.1)

5.2 ACCEPTANCE CRITERIA

Mechanical Run test is stated as conform, in absence of leaks, abnormal noise, vibrations and temperature increase.

6 PERFORMANCE TEST

6.1 DESCRIPTION

This test will be performed after Mechanical run test and consists in performance test of pump at 0bar, rated and PSV differential pressure at rated speed. It is performed at the end of the Mechanical run test.

The following parameters will be recorded: flow rate, water & stator temperature, differential pressure, pump speed, voltage, intensity, and power consumption of the motor.

Notes:

- Due to motor load, speed could be slightly different to pump datasheet,
- It is assumed that the suction pressure is equal to the atmospheric pressure, and the discharge pressure is equal to the differential pressure using water at "rated" temperature.
- As the project fluid density and viscosity is close to potable water it is not necessary to perform corrections to the test data.

6.2 ACCEPTANCE CRITERIA AT RATED PRESSURE

	Datasheet & Pump curves figures	Tolerances (Acceptance Criteria)	Test	
			Min	Max
Differential pressures (bar)	5.3 full length 6.5 reduced length	Manometer tolerance	5.2 6.3	5.4 6.6
Flow rate (m3/h)	2.5	As per API676 deviation	2.5	3.4
Mechanical power (kW)	1.45	+4%	0	1.51
Motor absorbed power (KW)	1.64	+4%	0	1.70
Fluid Temperature (°C)	10 to 30	Target 20°C	10	30
Pump speed (rpm)	118	+/-5	113	123

Note: 0barg & PSV set pressure (7.6barg corrected to 8.8barg – see note 2 below) figures & will be recorded for information without acceptance criteria.

Note2: Due to PCM well depth of 20/21 meters, Pumps will be assembled in short test configuration by removing 4 casing extension (12m) for a total length of 18m below mounting flange. Note that discharge pressure will be corrected to take into consideration the pump's sections removed. As we have 12m removed, Discharge pressure will be increased by 1.2bar.

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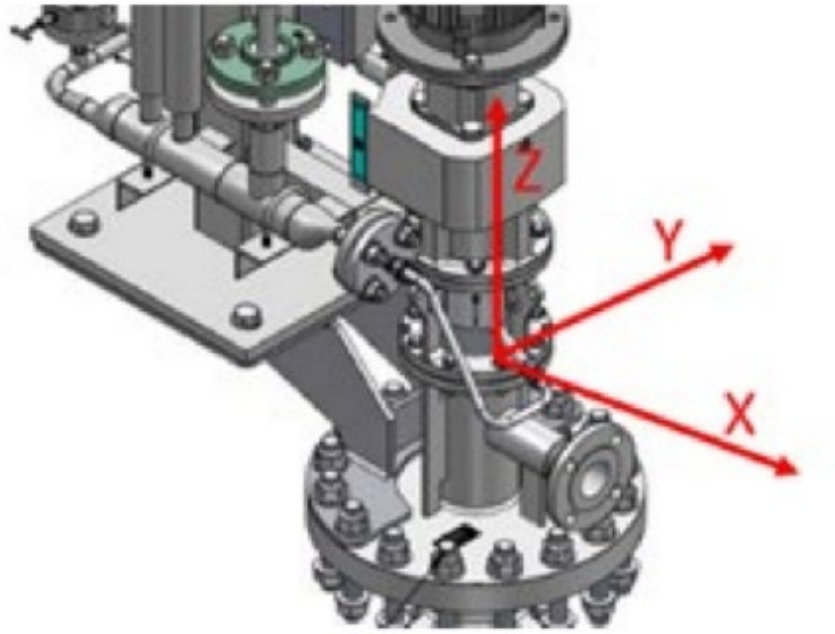
7 VIBRATION TEST

7.1 DESCRIPTION

The vibration test is performed on the pump during Performance test at rated conditions in our factory.

This test is performed according to API 676 section 6.11.1.

Vibration test will be performed at rated condition and measurements will be done on pump spacer.



7.2 ACCEPTANCE CRITERIA

The vibration level is recorded in X (radial), Y (axial) and Z (vertical) directions.

According to API 676, the maximum vibration level acceptable is:

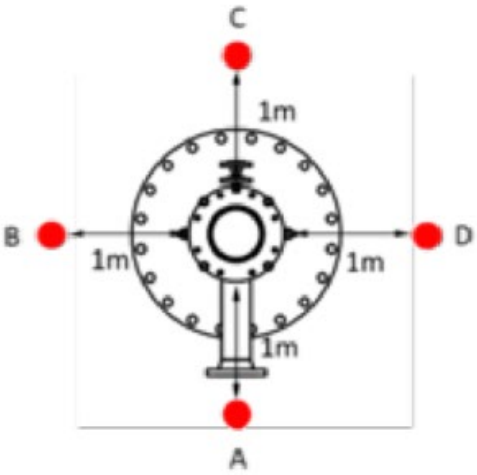
- Vu<7.1 mm/s RMS (with Vu the unfiltered velocity) on pump bearing housing.

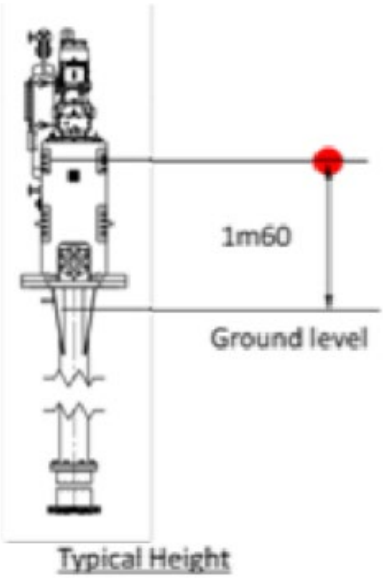
8 NOISE TEST

8.1 DESCRIPTION

The noise test is performed on the pump during Performance test at rated conditions in our factory before delivery. This test is performed according to the machinery directive 2006/42/EC.

Measurement will be performed at rated conditions at 1.6m height around the pump and 1.0 m from baseplate edge (see sketch below). The A-weighted emission sound pressure level at workstations is then measured in dB(A).





8.2 ACCEPTANCE CRITERIA

A-weighted emission sound pressure level ≤ 85 dB(A) @1m distance (in PCM factory environment)

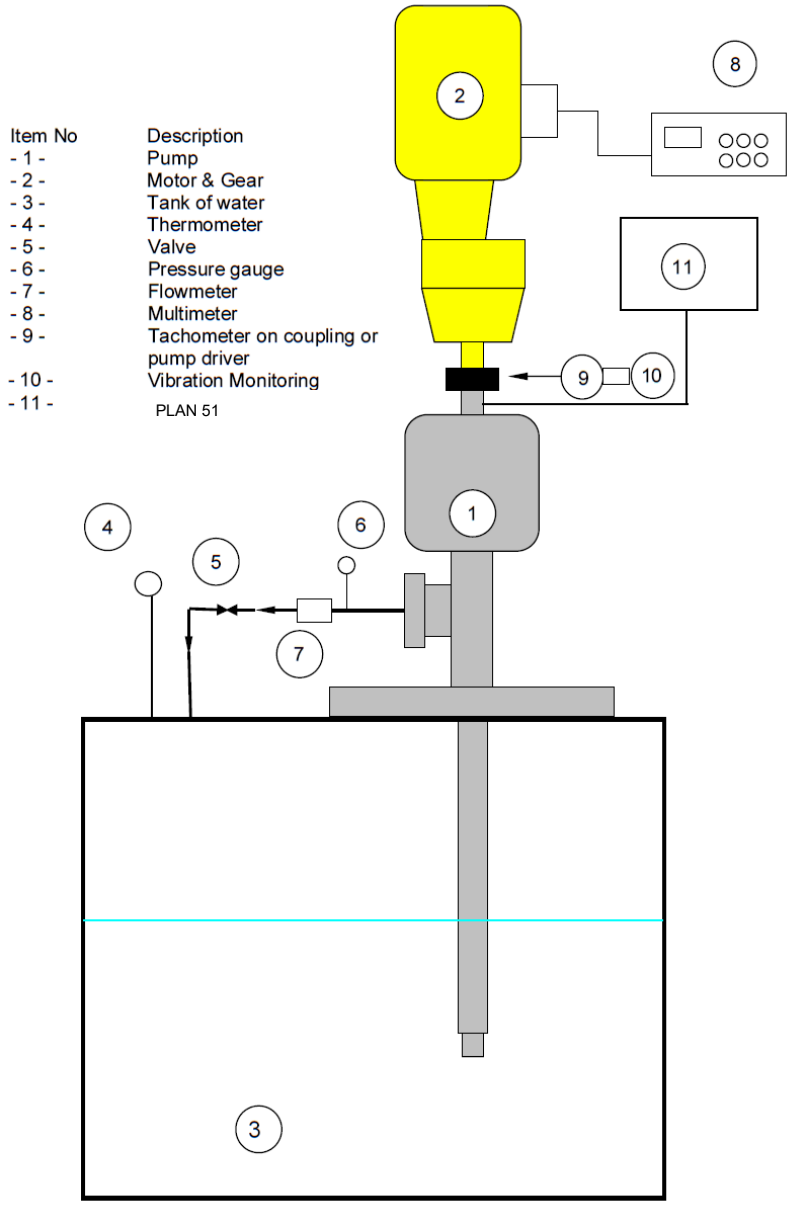
9 DIMENSIONAL CHECK, VISUAL INSPECTION & NAMEPLATES CHECK

Overall dimensions of the pump will be checked and compared to general arrangement drawing. This task will be performed using conventional measuring tape during Performance tests. Records will be compiled in Dimensional control report and GAD will be updated accordingly as as-built revision.

During this check, all nameplates will be also checked and compared to Nameplate drawings.

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10 FAT CONFIGURATION



Note: Sealing system PLAN 51 will be set as per Pump P&ID

11 APPENDIX – REPORT TEMPLATE

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PROCES VERBAL D'ESSAIS
TEST REPORT

REF. CLIENT / CLIENT REF : P300
NUMERO DE SERIE / SERIAL NUMBER : 070PCCC
MODELE / MODEL : 40A12

RAPPORT ESSAI DE PERFORMANCE / PERFORMANCE TEST REPORT

				instrument	
				TAG	Validity
PRESSION DIFFERENTIELLE DIFERENTIAL PRESSURE	bar	0	8		
DEBIT FLOW-RATE	m3/h				
VITESSE DE ROTATION OUTPUT SPEED	rpm				
TENSION VOLTAGE	V				
INTENSITE INTENSITY	A				
PUISSANCE ABSORBEE NOMINAL POWER	kW				
VARIATION DE FREQUENCE FREQUENCY VARIATION	Hz				
TEMPERATURE DU FLUIDE FLUID TEMPERATURE	°C				
TEMPERATURE DU STATOR STATOR TEMPERATURE	°C				

COMMENTAIRES:
COMMENTS

Résultat / ***Result :***

☐ Accepté / *Accepted*

☐ Non accepté / *Not accepted*

Date de l'essai / Test date

Test effectué par / Test carried out by

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PROCES VERBAL D'ESSAIS
TEST REPORT

REF. CLIENT / CLIENT REF : P300
NUMERO DE SERIE / SERIAL NUMBER : 070PCCC
MODELE / MODEL : 40A12

RAPPORT ESSAI D'ENDURANCE / RUN TEST REPORT

Test Duration Durée du test	

				instrument	
		beginning of the test Début du test	end of the test Fin du test	TAG	Validité Validity
HEURE HOUR					
PRESSION DIFFERENTIELLE DIFERENTIAL PRESSURE	bar				
DEBIT FLOW-RATE	m3/h				
VITESSE DE ROTATION OUTPUT SPEED	rpm				
TENSION VOLTAGE	V				
INTENSITE INTENSITY	A				
PUISSANCE ABSORBEE NOMINAL POWER	kW				
VARIATION DE FREQUENCE FREQUENCY VARIATION	Hz				
TEMPERATURE DU FLUIDE FLUID TEMPERATURE	°C				
TEMPERATURE DU STATOR STATOR TEMPERATURE	°C				

L'essai d'endurance est conforme en cas d'absence de fuite, de bruit anormal, d'augmentation des vibrations et d'augmentation de la temperature.
Mechanical Run test is stated as conform, in absence of leaks, abnormal noise, increased vibrations and increased temperature.

COMMENTAIRES:
COMMENTS

Résultat / *Result :*

☐ Accepté / *Accepted*

☐ Non accepté / *Not accepted*

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WW0221 Rapport d'essai vibration et bruit _Vibration and noise test report

PROCESS :	WR52	CODE :	WW0221	INDEX :	B
AUTHOR :	C. Guennec	ISSUE DATE :	2016-09-06	PAGE :	Page 1 of 1
CONFIDENTIALITY :	External				

Please make sure you use the latest version of the form when filling the record N° :

DONNEES POMPE ET ESSAI / *PUMP & TEST DATA*

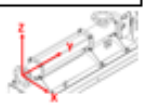
NUMERO DE SERIE / *SERIAL NUMBER*	
MODELE / *MODEL :*	
OPERATEUR / *OPERATOR NAME :*	
DATE DE TEST / *TEST DATE :*	
VITESSE POMPE / *PUMP SPEED :*	rpm
PRESSION D'ASPIRATION / *SUCTION PRESSURE :*	barg
PRESSION DE REFOULEMENT / *DISCHARGE PRESSURE :*	barg
ESSAI REALISE / *TEST REALIZED :*	☐ Essai de vibration / Vibration test **Appareil d'essai / Test device** -Numéro de série / Serial number : …… -Certificat de calibration valide jusqu'à / Certificate of conformity valid until : …… ☐ Essai de bruit / Noise test **Appareil d'essai / Test device** -Numéro de série / Serial number : …… -Certificat de calibration valide jusqu'à / Certificate of conformity valid until : ……

RAPPORT D'ESSAI DE VIBRATION / *VIBRATION TEST REPORT*

Critère d'acceptation / *Acceptance criteria :* ☐ Vibration ≤ 3.8mm/s RMS ☐ Vibration ≤ 7.1mm/s RMS ☐ Other : vibration ≤ …. mm/s RMS

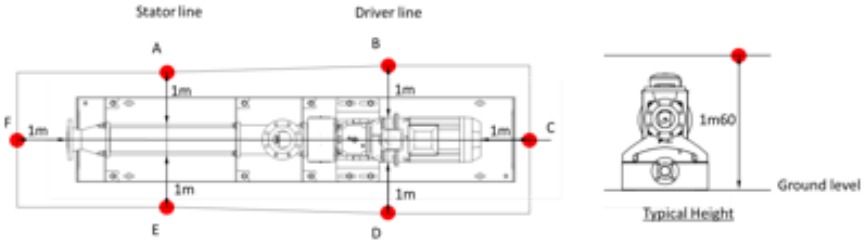
Direction / Direction	X (radial)	Y (axial)	Z (vertical)
Niveau de vibration au palier / *Vibration level on bearing* [mm/s RMS]	mm/s	mm/s	mm/s

Résultat / *Result :* ☐ Accepté / *Accepted* ☐ Accepté sous dérogation / *Accepted under derogation* ☐ Non accepté / *Not accepted*



RAPPORT D'ESSAI DE BRUIT / *NOISE TEST REPORT*

Critère d'acceptation / *Acceptance criteria :* Niveau de pression acoustique / *Sound pressure level* ≤ 80 dB(A)



Application point	A	B	C	D	E	F
Niveau de bruit / *Noise level*	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)	dB(A)

Résultat / *Result :* ☐ Accepté / *Accepted* ☐ Accepté sous dérogation / *Accepted under derogation* ☐ Non accepté / *Not accepted*

http://mypcm.world.pcm.local/en/sbu-department/Quality/Lists/pcm-public-documents/WW0221_Rapport%20d%E2%80%99essai%20vibration%20et%20bruit%20_Vibration%20and%20noise%20test%20report.docx