

Course on

Wastewater Pumping

Stations Design

Lecture 11

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Lecture 11

Wastewater Pumps FAT & SAT.

10-1 FAT

- FAT : Factory Acceptance Tests.

1-The Contractor / Supplier shall secure from the pump manufacturer certification that the following internal inspections and tests have been conducted on each pump at the factory, and submit to the Client / Consult prior to FAT witness proposed:

- (a) the pump casing has been tested hydrostatically to 1.5 times the maximum closed valve pressure
- (b) impeller, motor rating and electrical connections checked for compliance with the Project Specifications
- (c) motor and cable insulation tested for moisture content or insulation defects
- (d) prior to submergence, the pump has been run dry to establish correct rotation and mechanical integrity
- (e) the pump have to run for 30 min. submerged under a minimum of 2 m water
- (f) after the operational test above, the insulation tests (c) above has been performed again, and after the performance test (2) below
- (g) NPSH (for dry well mounted pumps only)

10-1 FAT

- FAT : Factory Acceptance Tests. (Cont.)

2- Each pump shall tested at the factory for performance according to BS EN ISO 9906 Grades 1, 2 and 3, including:

(a) flow

(b) inlet pressure

(c) outlet pressure

(d) motor power

(e) torque

(f) efficiency

(g) Net Positive Suction Head (NPSH) (valid for all type of pumps).

10-1 FAT

- FAT : Factory Acceptance Tests. (Cont.)

3- The Contractor shall secure from the pump manufacturer the following certification and submit to the Engineer prior to shipment:

- (a) certified copies of the pump characteristic curves and reports generated by the tests described above and as required by BS EN ISO 9906 Grades 1,2 and 3.
- (b) foundry composition certificates for all major castings (pump case, impeller, motor housing) showing exact material composition and tests conducted to ensure compliance with the pump manufacturer's material specifications.

10-1 FAT

- FAT : Factory Acceptance Tests. (Cont.)

3- The Contractor shall secure from the pump manufacturer the following certification and submit to the Engineer prior to shipment:

(c) the lifting chains, rings and shackles shall be load tested and Proof tested compare with one of the below mentioned applicable codes requirements, and clearly and permanently tagged with the SWL. Test certificates shall be supplied with Authorized Third Party Agency (TPA) approval.

Other Parts such:

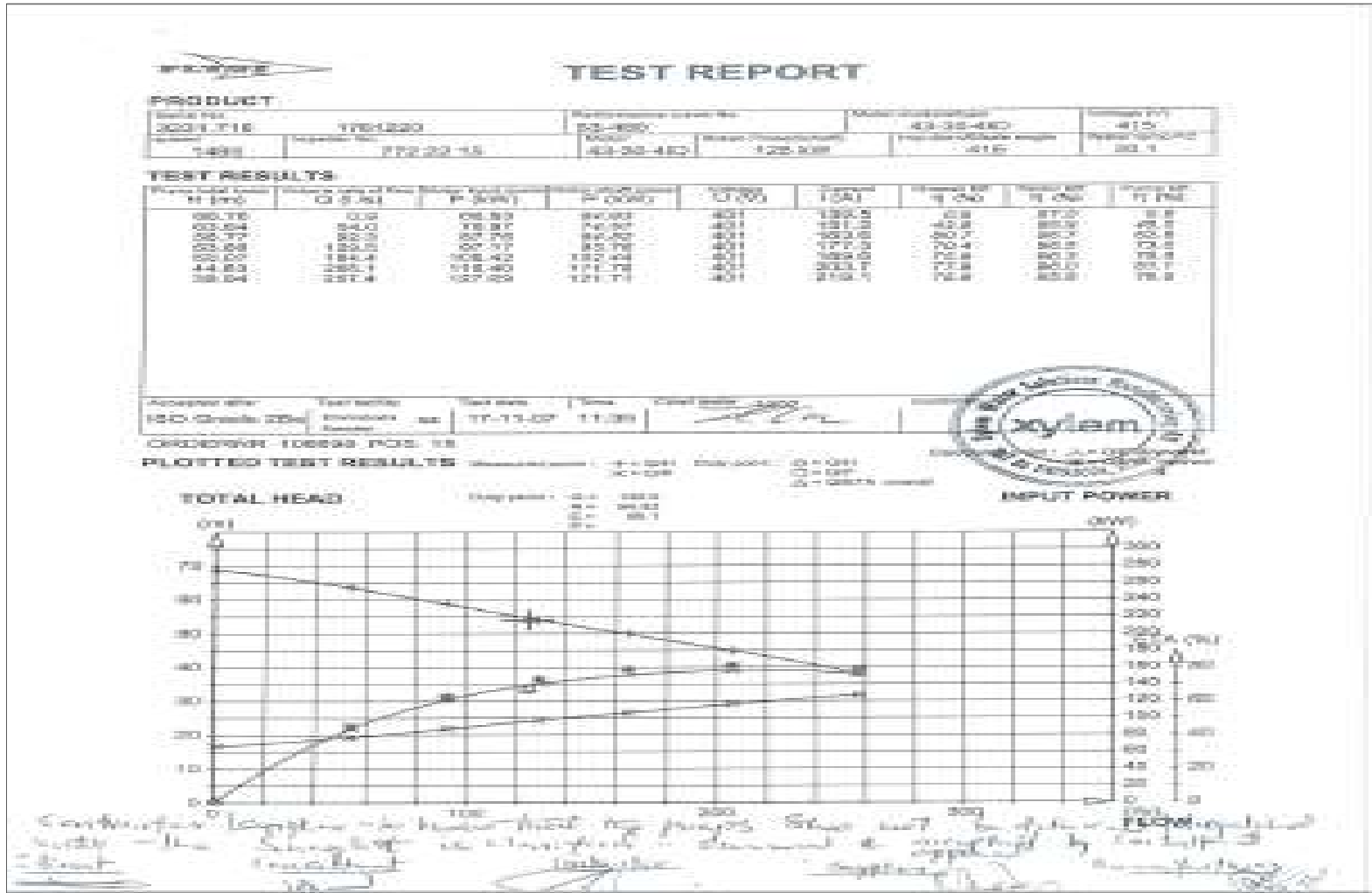
Chain (sling and hooks): BS 4942 part 1 and 6 / ISO 2903 / ISO 7595

Shackles : BS 3551 / BS 3032 / BS 6994

Ring and Links : BS 2902

10-1 FAT

- FAT : Factory Acceptance Tests. (Examples.)



10-1 FAT

- FAT : Factory Acceptance Tests. (Examples.)

xylem Lath Soha Water Xylem Water Solutions AB
Document No.:

VIBRATION TEST REPORT

ISO

Project: Refurbishment & Upgrading Works of Ashghal PS
 Your order No.: FPO 18571000061
 Our order No.: 108698 Pos 15
 Product: 3231.716-5008
 Serial No.: 1781220
 Impeller: 772 22 15
 Rated speed: 1435 RPM

ISO 10816:2011
 Break & Repair, Mod 2013

SWITCH SETTINGS OF TYPE 2013
 Break & Repair

Sensor location:

G-TECH-GT-3317 (VIM), Measuring mode "VEL"
 MC42, Measuring mode "ISO"

VIBRATION LIMIT	ISO	7.1 mm/s	RESULTS			
			Flow	ISO		
			Vibration levels (mm/s) RMS			
			Sensor position			
			(a)	b	c	d
			1.0	0.8	1.3	1.0

Date: 2017-11-07
 Emmaboda

Tested by: *Magnus Johansson*
 Magnus Johansson

xylem Lath Soha Water Xylem Water Solutions AB
TEST REPORT Document No.:

NOISE LEVEL TEST

Project name: Refurbishment & Upgrading Works of Ashghal PS
 Your order No.: FPO 18571000061
 Our order No.: 108698
 Product: 3231.716-5008
 No. of units: 1
 Serial Nos.: 1781220

We hereby certify that the above mentioned Flygt product is noise level tested according to ISO 9014-2.

Pump type:
 Centrifugal pump
 Propeller pump or Agitator

For centrifugal pumps, the measurement was made as a sound power measurement over five areas close to the pump.
 For Propeller pumps and Agitators, the measurement was made as sound pressure level.
 The distance between the measured object and the probe was 1 meter.

Testresult: 76,6 dB(A)

Emmaboda Nov 07, 2017
 Xylem Water Solutions AB
 Product Shop OPTA

Magnus Johansson
 Magnus Johansson

18-850/14

10-1 FAT

- FAT : Factory Acceptance Tests. (Examples.)


DEUTSCHE EDELSTAHLWERKE
 Producing special steel solutions

Material No.: 1.4571
 Order No.: 021000000
 Order No.: 001000000
 Order No.: 001000000

Supplier No. 14571000000	Order No. 001000000	Material No. 1.4571	Production No. 00000
Customer No. 00000	Order No. 001000000	Material No. 1.4571	Production No. 00000

Chemical Composition / Chemical Composition / Composition chimique

	C	Si	Mn	P	S	N	As	Cu	Cr	Mo	V	W	Co	Al
Max. Allowed	0,22	0,03	0,25	0,003	0,003	0,001	0,01	0,05	0,18	0,005	0,005	0,005	0,005	0,005
Min. Allowed	0,02								16,5					

Mechanical Properties / Mécanical Properties / Propriétés mécaniques

Property	Value
Tensile strength (Rm)	570
Yield strength (Rp0,2)	275
Elongation (A)	22

Dimensions / Dimensions / Dimensions

Property	Value
Tensile strength (Rm)	570
Yield strength (Rp0,2)	275
Elongation (A)	22




 Xylem Water Solutions Manufacturing AB

MATERIAL SPECIFICATION, EN 10 204-2.2

Customer: XYLEM WATER SOLUTIONS (SWEDEN) AB/ME
 Your order No.: 0210017
 Our order No.: 100 000
 Product: NT 3201710
 No. of units: 3
 Serial Nos.: 120 1204-1205, 177 1030

Attached find material inspection certificate according to EN 10204 / 2.2 for shaft part no. 780 00 00 used in above mentioned pumps.

Ernsjöbohov Nov 06, 2017

Xylem Water Solutions Manufacturing AB
 Fredrik Sjögren



10-1 FAT

- FAT : Factory Acceptance Tests. (Examples.)



**SMÅLANDS
STÅLGJUTERI AB**
50 years in the industry 1967 - 2017

TEKNISSKEMMANO
A 02
B 01

ÖVERSIKTSPLAN

Order No. 100000		Date 2017-11-08	
Customer Xylem Water Solutions		Project Xylem Water Solutions	
Drawing No. 100000		Revision 01	
Drawing Title		Drawing Date	
Drawing Scale		Drawing Status	

Order No.	Order Date	Order Qty	Order Unit	Order Price	Order Total	Order Status
100000	2017-11-08	1	0		0.00	

Order No.	Order Date	Order Qty	Order Unit	Order Price	Order Total	Order Status
100000	2017-11-08	1	0	34.00	34.00	

Signature: 

Stamp: 



Xylem Water Solutions Manufacturing AB

MATERIAL SPECIFICATION, EN 10 204-2.2

Customer: XYLEM WATER SOLUTIONS SWEDEN AB ME
 Your order No.: 6210397
 Our order No.: 100000
 Product: NT 3231.710
 No. of tests: 3
 Serial Nos.: 175 1204, 1205, 177 1038

Attached find material inspection certificate according to EN 10204 7.2.2 for
 bipolar part no. 772 22 15 & 772 23 00 used in above mentioned pumps

Emmaboda Nov 08, 2017

Signature: 
 M-L Larsson

Stamp: 

10-1 FAT

- FAT : Factory Acceptance Tests. (Examples.)

Xylem Water Solutions Manufacturing AB

ELECTRICAL TEST REPORT

Drawn and for: _____


PRODUCT	MOTOR	SERIAL NUMBER
3231.710	43-30-4E3	1761204

NO LOAD TEST


Voltage V	I ₀	Current A I ₀	Power W ₀	Frequency Hz
411.0	104.9	106.1	103.7	50

ELECTRIC TEST

Test Volt V	Electric test Duration s	Passed	Winding Insul. (200V)		Winding resistance			Wt. loss g
			Before MΩ	After MΩ	U1 - U2 Ohm	U2 - U3 Ohm	U1 - U3 Ohm	
2500	60	OK	>1000	>1000	0.0434	0.0433	0.0433	



Comments: _____

Drawn by	Test facility	Test date	Time	Signature
Sachin	Q2	2017-10-31	16:24	

Xylem Water Solutions Manufacturing AB

TEST REPORT

HYDROSTATIC TEST PUMPHOUSING ACCORDING TO EN 12 162

Customer: XYLEM WATER SOLUTIONS SWEDEN AB ME
 Your order No.: 0210017
 Our order No.: 100 000
 Product: NT 3231.710
 No. of units: 3
 Serial Nos.: 176 1204, 1205, 177 1000

Discharge diameter: 200 mm
 Maximum working pressure in MPa: 1.8 MPa
 Maximum working temperature: 40 °C
 Test duration: 10 min

We hereby certify that the pump housing for Flygt products mentioned above are pressure tested with an inside water pressure of 2.4 MPa.

No leakage or damage was found.

Emmaboda Nov 03, 2017

Xylem Water Solutions Manufacturing AB
 Product Dept PVT




641 Lemnaboda

10-1 FAT

- FAT : Factory Acceptance Tests. (Examples.)

xylem
Let's take Water

Xylem Water Solutions Manufacturing AB

**CERTIFICATE OF CONFORMANCE
PAINTING**

Customer:	XYLEM WATER SOLUTIONS SWEDEN AB ME
Your order No.:	6210117
Our order No.:	100000
Product:	NT 323.710
No. of units:	3
Serial Nos.:	170 1204,-1205, 177 1030

We hereby certify that the paint thickness and surface treatment on the above mentioned product corresponds to Xylem Water Solutions standard M0700.00.0008 in 14E53 Inch Green.

Emmaboda Nov 03, 2017
Xylem Water Solutions Manufacturing AB
Product Group PWT



xylem
Let's take Water

Xylem Water Solutions Manufacturing AB

**CERTIFICATE OF CONFORMANCE
BALANCING**

Customer:	XYLEM WATER SOLUTIONS SWEDEN AB ME
Your order No.:	6210117
Our order No.:	100000
Product:	NT 323.710
No. of units:	3
Serial Nos.:	170 1204,-1205, 177 1030
Impeller part No.:	772 22 10
Shaft unit part No.:	771 30 00

We hereby certify that the rotating parts for above mentioned Pflugi product is balanced according to ISO 1940-1, G0.3 Xylem Water Solutions standard!

Emmaboda Nov 03, 2017
Xylem Water Solutions Manufacturing AB
Product Group PWT



10-1 FAT

- FAT : Factory Acceptance Tests. (Examples.)

FWALD - PRODUKTE
Page 1 of 1

Module name: FWALD-PRODUKTE

Module address: 192.168.1.100

Serial number: 2007-11-07-000000

Alarm status: OK

MAS Web tool

View

- AAA network overview
- Global overview
- Trend diagrams
- Flowing variables
- Active alarms
- Alarm and event log
- Temp. stator ph. 1-3
- Temp. stator ph. 1
- Temp. stator ph. 2
- Temp. stator ph. 3
- Temp. main bearing
- Temp. support bearing
- Temp. pump motor
- Leak. stator bearing
- Leak. journal box
- Vibration
- Pump running
- Total running time
- Total starts

Quick overview 2017-11-07 12:46:28

Monitoring function	Status	Value	Max	Min	Reset date
Temp. stator ph. 1-3	OK	112.0 °C	220.0	-1.1	2017-11-07
Temp. stator ph. 1	OK	89.8 °C	88.7	21.1	2017-11-07
Temp. stator ph. 2	OK	87.9 °C	87.6	20.3	2017-11-07
Temp. stator ph. 3	OK	72.8 °C	72.5	25.3	2017-11-07
Temp. main bearing	OK	70.1 °C	78.5	21.0	2017-11-07
Temp. support bearing	OK	44.3 °C	44.5	20.8	2017-11-07
Temp. pump motor	OK	81.7 °C	21.7	20.8	2017-11-07
Leak. stator bearing	OK	10 mA	10	10	2017-11-07
Leak. journal box	OK	10 mA	10	10	2017-11-07
Vibration	OK	2.2 mm/s	13.5	0.4	2017-11-07
Pump running	OK	On	On	On	2017-11-07
Total running time		2.5 h			2017-11-07
Total starts		1			2017-11-07

Reset status

https://192.168.45.3/mas/000
2017-11-07

10-2 SAT

- SAT : Site Acceptance Tests.

- 1- General : The equipment delivered to the Site shall be examined by the Contractor to determine that it is in good condition and in conformance with the approved working drawings and certifications. All equipment shall be installed in strict conformance with Part 1 of this Section and the manufacturer's instructions.
- 2- If required in the Project Specification, or in the case of submersible pumps rated at -- kW or greater, the Contractor shall provide the services of the pump manufacturer's representative to supervise the installation, commissioning and start-up of the pumping equipment.

10-2 SAT

- SAT : Site Acceptance Tests. (Cont.)
- 3- The commissioning tests shall be performance and reliability trials, mainly for the purpose of satisfying the Engineer that the pump sets have been correctly assembled and installed and that their performance matches that obtained during the manufacturer's works tests. In the event of an unwarranted change in the pump performance characteristics or power consumption, all necessary steps shall be taken as soon as possible to establish the cause and remove the fault. Similar action shall be taken for an undue increase in bearing or gland temperature, increased gland leakage rates, unsatisfactory vibration levels or any other fault or defect in the operation of the pump set.

10-2 SAT

- SAT : Site Acceptance Tests. (Cont.)

4- The site reliability trials shall include the following:

- (a) a record of bearing and coupling clearance and alignments shall be tabulated to show the “as-built” condition of each pump.
- (b) a record of all overload, timing relay and oil pressure relays shall be tabulated to show the “as-built” condition of each motor starter.
- (c) all cables shall be “megger” tested to confirm the integrity of the insulation. A tabulated record of results shall be made.
- (d) the control panel shall be statically tested with motors disconnected to confirm the correct sequence of operation.

10-2 SAT

- SAT : Site Acceptance Tests. (Cont.)

4- The site reliability trials shall include the following: (Cont.)

(e) each pump shall be operated individually over the range from closed valve to maximum emergency top water level, on a recirculation basis, using fresh water, and for a minimum of four hours continuously. During this test the following parameters will be recorded:-

- | | |
|------------------------------------|----------------------------------|
| (i) motor phase currents | (ii) pump output |
| (iii) ambient and test water temp. | (iv) motor/pump casing temp. |
| (v) power consumed | (vi) power factor |
| (vii) Vibration | (viii) signs of cavitation noise |

10-2 SAT

- SAT : Site Acceptance Tests. (Cont.)

4- The site reliability trials shall include the following: (Cont.)

(f) the commissioning trials shall extend until each pump unit has run “continuously” for at least 3 days under all operating conditions.

The term “continuously” shall include running at various speeds or on a start/stop basis as determined by the control system.

(g) the Contractor's supervisory staff, and the pump manufacturer's representative, if required by the Project Specification or the above, shall be present during the period of the tests and trials. The Contractor shall be responsible for any failure of the whole equipment or any part thereof, whether such failure shall be determined by the methods detailed herein or otherwise. If the pump test or trial is interrupted by the Contractor, or through negligence on the part of the Contractor's staff, it shall be completely repeated for the pump set concerned. 18

10-2 SAT

- SAT : Site Acceptance Tests. (Cont.)

Attached an Excel File (B.S.) for Field Pump test calculator allows detailed testing of pumps in the field. There are four different tabs that directly address testing of :

- 1- Above ground centrifugal (suction & discharge gauge method),
- 2- Submersible wastewater (discharge gauge method) and
- 3- Line shaft turbines (discharge gauge method).

After entering the required data the calculator will calculate: velocity, velocity head, TDH, average voltage, average current, unbalanced voltage and current, water HP, test point HP, pump efficiency and the cost per 1000 gallons pumped.

If multiple points are tested an H/Q test curve is generated automatically on page 3. All equations used for calculations are shown on the spreadsheet. Complete instructions are included.

Attached

- **ISO 9906_2012. Rotodynamic Pumps-
Hydraulic Performance Acceptance
Tests. Pdf.**
- **Pump Field Test Procedure. Excel Sheet.**
- **Pumps-Vibration-Measurement-
Allowable-Values**

Next
Lecture - 12
Wastewater P.S. Valves

Thank You