HVAC

BRISBANE CITY COUNCIL

BRISBANE WATER

OPERATING AND MAINTENANCE MANUAL SECTION 3.2 COMPLETED COMM PLAN & REPORTS for

REDIRECTION OF HEROES AV SEWAGE PUMP STATION, MECHANICAL & ELECTRICAL FIT & COMMISSIONING

HVAC Queensland Pty Ltd

CONTRACT NO. BW.30079-02/03

Principal Contractor
HVAC/HPS QUEENSLAND PTY LTD

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HVAC Job No 3115Q

BVQi QUALITY ASSURED QA ISO 9001 APPROVED COMPANY

ELECTRICAL SERVICE REPORT

3251-01

Qld Electrical Contractor: 57221

HVAChps
101 Cobalt St, Carole Park
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Telephone: (61-7) 3712 3400
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HVAC hps JOB NO.	CLIENT'S ORDER NO.:
3251	

CLIENT:
Brisbane City Council

ADDRESS WHERE THE ELECTRICAL WORK WAS UNDERTAKEN:
Heroes Ave. Sewerage Pump Station SP103 Taringa.

POSTAL ADDRESS (IF DIFFERENT FROM ABOVE):

DETAILS OF WORK :Installation of 3 phase consumer mains from padmount transformer to main switchboard. Installation of new main switchboard. Installation of 3 phase supplies to 3 Pumps. General light and power throughout pump station building. Associated controls and ancilliary equipment relating to the operation of the pump station. Equipment generally as detailed on drawing no. 0203-E101 Rev B Schematic Diagram. As Built. Main Switchboard constructed and approved as per design drawings. Commisioning sheets attached.

DETAILS OF REPAIRS PERFORMED (IF APPLICABLE):

DETAILS OF DEFECTS *(HIGHLIGHTED POST-INSTALLATION/REMEDIED)

We hereby certify that the Works on the above-mentioned installation have been inspected and tested in accordance with the Prescribed Procedure and that such work complies with the requirements of AS/NZS3000:2000, The Electricity Act, and its Amendments, and has been connected to the source of supply.

* Cross out that which is not applicable.

ELECTRICIAN (PRINT NAME): Ian Reed	CERTIFICATE OF COMPETENCY: 36679
SIGNATURE OF ELECTRICIAN:	DATE: 2/09/05
SIGNATURE OF CLIENT REPRESENTATIVE:	DATE:

Activity No.	Commissioning Activity	Duration	Comments
4.1	Pipework Hydrostatic Pressure Testing	29/07/2005 to 04/08/2005	1. 29/07/05 – First BW witness test, test failed due to pump 3 suction line leakage 2. 04/08/05 – Second BW witness test, test passed and signed off by Reg McGirr
4.2	Switchboard Pre-Commissioning SAT	13/07/2005 to 20/07/2005	1. 13/07/05 – Earthing and general wiring & visual inspection completed, witnessed by Mike Tomlinson 2. 14/07/05 – Continuity test, meggaring of pump motors, witnessed by Mike Tomlinson 3. 15/07/05 – Component operational test barring pumps, instrumentation and generator tests which were seperately tested in 4.4, 4.5 and 5.1 4. 20/07/05 – Field I/O points checked
4.3	VSDs Programming	19/07/2005 to 11/08/2005	1. 19/07/05 – Danfoss programmed drive 1, drive 2 exploded during AMA test 2. 20/07/05 – Danfoss programmed drive 3 off drive 1 settings 3. 22/07/05 – Danfoss repaired drive 2 4. 23/07/05 – Drive 2 re-installed into switchboard 5. 25/07/05 – Drive 2 programmed off drive 1 settings 6. 11/08/05 – Modified parameters during functional testing (Parameter 117 – enable pump thermistor functionality, Parameter 207 – increase ramp down time to reduce DC link overvoltage when emergency stop was pressed on the respective running pump)
4.4	Pumps Pre-Commissioning Testing	08/08/2005	1. 08/08/05 – All 3 pumps local start/stop ok, rotation ok, prior to 5.2 Pump Performance Testing, witnessed by Reg McGirr and Grant Kerr

Activity No.	Commissioning Activity	Duration	Comments
4.5	Instrument Calibration and Commissioning	20/08/2005 to 21/08/2005	1. 20/08/05 – ABB flowmeter calibration, Calmaster equipment battery failed during calibration, witnessed by Mike Tomlinson 2. 21/08/05 – ABB flowmeter calibration ok, refer ABB Verification Certificate 3. 05/08/05 – Vega pressure transmitter calibration, calibrated pressure gauge failed during test, witnessed by Mike Tomlinson 4. 08/08/05 – Vega pressure transmitter calibration, readings approx 10% error, witnessed by Reg McGirr 5. 09/08/05 – Vega pressure transmitter calibration ok, refer Instrument Calibration Sheet, witnessed by Reg McGirr and Mike Heritage
5.1	Switchboard Functional Testing	09/08/05 to 13/08/05	1. 09/08/05 – Switchboard functional tests ok including pumping action and PID tuning when wet well was gradually filled with more water, refer HVAC and Brisbane Water NCS Functional Test Sheets, witnessed by Reg McGirr 2. 10/08/05 AM – Switchboard functional test – BW Alex Witthoft completed own tests including pumping action when water was pumped out of wet well, also tested pump thermistor and other field I/Os – refer HVAC and Brisbane Water NCS Functional Test Sheets. 3. 10/08/05 PM – Generator control plug was reinstated to the switchboard to test generator. This immediately caused the ATS to changeover to backup supply. Grant Kerr identified incorrect wirings in both MCBR and GCBR relays. This resulted in blown GCBR relay and PFR1 fuse in the switchboard, and blown I/O fuses at the generator end. The wirings were immediately fixed by Grant Kerr while damaged parts were replaced the following day 11/08/05 AM. 4. 11/08/05 – Switchboard functional test – All generator tests ok, witnessed by Reg McGirr 5. 13/08/05 – Fixed Grundfos Moisture in Oil SARI2 relay wirings, wirings were incorrect prior. All 3 oil relays tested ok including simulating alarms to PLC.

(rr) ..Heroes Ave Commissioning Report.doc

Activity No.	Commissioning Activity	Duration	Comments
			* Note VSDs trip on Alarm 7 – DC Link Overvoltage when emergency stop of a pump running at full speed was engaged. This was rectified on 11/08/05 when Danfoss advised increasing ramp down speed. * HOWEVER, during generator testings on 11/08/05, Alarm 7 re-occurred due to VSDs loosing total power (ie. No control supplies to VSDs). This is different to an emergency stop scenario because e-stops do not interrupt control supplies. The alarms were identifed as a design issue.
5.2	Pump Performance Testing	08/08/05 to 09/08/05	1. 08/08/05 – 50Hz, 40Hz, 33Hz single pump points tested and recorded, witnessed by Reg McGirr and Andrew White. Note approximate pressure gauge of '+8m' was used during recordings 2. 09/08/05 – 28Hz single pump and 50Hz two pumps points tested and recorded, witnessed by Reg McGirr.
5.3	Harmonic Filter Commissioning	11/08/05	ECO commissioned harmonic filter including recording of harmonics, refer to commissioning report dated 15/08/05

Notes

- 50Hz, 40Hz, 33Hz single pump performance testing taken at level 6360mm from survey point to first-filled water level (equivalent to 26 to 29% on wet well level gauge)
- 28Hz single pump and 50Hz two pumps perfomance testing taken at level 5357mm from survey point to second-filled water level (equivalent to 42 to 43% on wet well level gauge)
- 0% to 100% wet well level gauge is equivalently ranged from 0 to 8 metres (existing Vegawell 72 level transmitter calibrated by Bill Collie)

(rr) ..Heroes Ave Commissioning Report.doc

Brisbane Water

hps HVAC

SP103 Heroes Avenue Sewage Pump Station Commissioning Plan

REDIRECTION OF HEROES AVE SEWERAGE PUMP STATION, MECHANICAL & ELECTRICAL FITOUT & COMMISSIONING
CONTRACT: BW.30079-02/03
REF: 243-98-30082/2002/2003

ISO 9001 APPROVED COMPANY

Prepared by: William Wong

Last revision: 16/08/2005

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1. VERSION CONTROL

Version	Date	Author	Details
1.0	12/05/05	William Wong	Initial Draft
1.1	02/06/05	William Wong	Update on draft
1.2	10/06/05	William Wong	Update / additions
1.3	04/07/05	William Wong	Update to reflect comments by Brisbane Water and Common Logic
1.4	14/07/05	William Wong	Update to reflect comments by Brisbane Water and site meeting on 12/07/05
1.5	21/07/05	William Wong	Update to reflect comments by Brisbane Water and site meeting on 19/07/05
1.6	28/07/05	William Wong	Update to reflect comments by Brisbane Water at site meeting on 28/07/05: - Update recirculating system drawing - Update timeline on page 11 - Correct pump nameplates on page 19
1.7	03/08/05	William Wong	Update to reflect comments (made on site 02/08/05) on changing method of calibrating the pressure transmitter – pages 22 to 23
1.8	16/08/05	William Wong	Update to reflect changes to harmonics recording

2. COMMISSIONING PLAN

2.1 Purpose

This plan details the description of methods and processes involved in site testing the Heroes Avenue Pump Station portion of Contract BW.30079-02/03, including pre-commissioning and commissioning of the system resulting in the production of a Commissioning Inspection and Test Plan (ITP).

2.2 Scope

The scope of the project consists of the removal of old switchboard and pumping system, and the installation of a new switchboard and pumping system that is redirected into the S1 sewer line.

The switchboard is tested separately in the workshop and then delivered to site to be installed by HVAC. The construction of the switchboard follows the process of sheet metal, minor bar works, power cable works, then electrical and control fit out.

Electrical installation follows the process of mains cabling, generator cabling, pumps cabling, and electrical and control cabling for field devices, as per cable schedule.

Mechanical installation follows the process of pumps installation, and associated pipework and valves installation, as per issued for construction drawings.

2.3 References

2.3.1 Specifications

- Commissioning attachment of Contract BW.30079-02/03 Redirection of Heroes Avenue Sewage Pump Station, Mechanical & Electrical Fitout & Commissioning
- Brisbane Water Heroes Avenue Pump Station Functional Specification
- All associated Brisbane Water specifications supplied for the project

2.3.2 Drawings

- All electrical drawings as per specification supplied by Brisbane Water (Drawings no. 486/5/7-LIO10 to 486/5/7-LIO30)
- All civil and mechanical drawings as per specification supplied by Brisbane Water (Drawings no. 486/5/7-LI005 to 486/5/7-LI009)
- All associated Brisbane Water standard drawings supplied for the project
- Switchboard sheet metal design drawings supplied by MPA Engineering (Drawings no. 7690-G10 to 7690-G12)
- Harmonic filter circuit diagram and general arrangement drawings supplied by Capacitor Technologies (Drawings no. CT-3750E1, CT-3750M11)

2.3.3 Testing and Certifying Documents

- Switchboard Factory Acceptance Testing (FAT) document supplied by MPA Engineering
- Hydrostatic pressure test sheets and report
- Switchboard Pre-commissioning Site Acceptance Testing (SAT) document supplied by Common Logic
- Factory calibration certificates for pressure transmitter and flowmeter instrumentation
- Variable speed drives programming parameter record
- Pumps pre-commissioning test sheets
- Switchboard functional test sheets
- Pump performance testing record
- Pump schedule/curve and factory certifying documents
- Brisbane Water Network Control Systems Pre-commissioning Acceptance Test Document
- Brisbane Water Network Control Systems Site Acceptance Test Document
- Defect Notice Template

2.3.4 Management Plans & Documents

- Site Environmental Management Plan
- Site Workplace Health & Safety Plan
- Project Quality Plan

2.4 Staff Responsibilities

Project Manager – Graham James, to prepare commissioning plan, ensure that ITPs are complete and pre-commissioning done prior to commissioning, coordinate commissioning activities, and to observe and verify as required.

Project Engineer – William Wong, to prepare commissioning plan, coordinate and assist in pre-commissioning and commissioning activities.

Mechanical Supervisor – Rene Bongers, to conduct mechanical pre-commissioning activities, and to assist in commissioning as required.

Commissioning Engineer – Common Logic – Grant Kerr, to commission pump station station as per contract specification 4.2.1.

Energy Correction Options (ECO) – Paul Crust, to commission harmonic filter and record harmonics the station under various loads detailed in the specification.

Vega Australia Representative – Bradley Bailey, to calibrate and commission pressure transmitter, and to provide certification documents.

ABB Australia Representative, to calibrate and commission flowmeter, and to provide certification documents.

Grundfos Pumps – Andrew White, to certify correct pump installation, and observe and verify pump performances conform to specification.

Danfoss Australia – Nick Taylor, to assist in programming the VSDs, and observe and verify its correct operation.

SE Power Representative, to commission Brisbane Water generator set.

BW Commissioning Representative – Reg McGirr, to witness commissioning activities, and to observe and verify as required, as per contract specification 4.2.2.

BW Networks Representative – Alex Witthoft, to program, operate and monitor the PLC and RTU to ensure proper operation of the pump station control system.

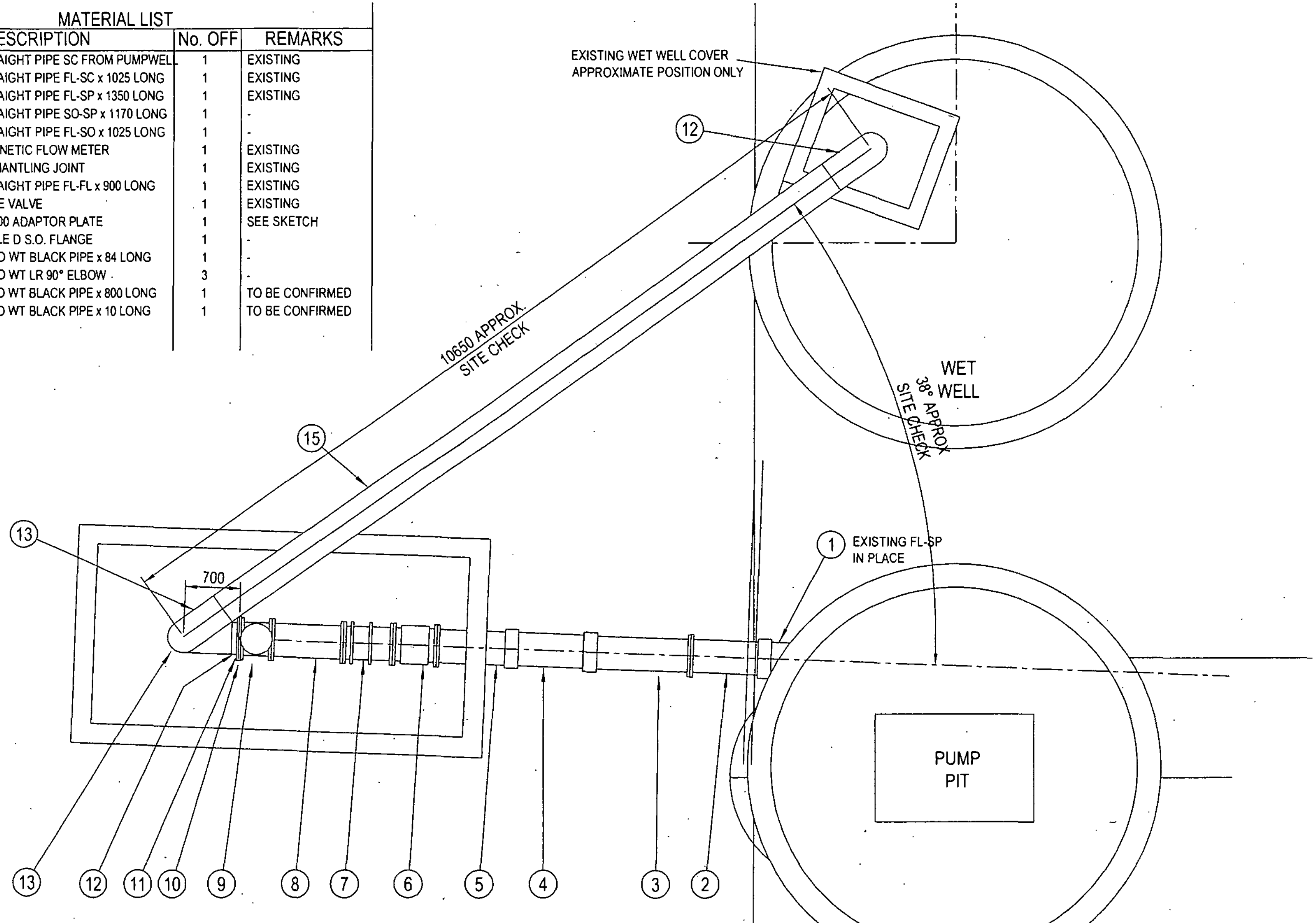
2.5 Fresh Water Recirculating System

Due to the unavailablility of the S1 sewer line in time for the commissioning of the Heroes Avenue Sewage Pump Station, the decision was made to commission the station using a fresh water recirculating system arrangement.

< Insert details and drawing of fresh water recirculating system arrangement >

MATERIAL LIST

ITEM	DESCRIPTION	No. OFF	REMARKS
1	DN375 STRAIGHT PIPE SC FROM PUMPWELL	1	EXISTING
2	DN375 STRAIGHT PIPE FL-SC x 1025 LONG	1	EXISTING
3	DN375 STRAIGHT PIPE FL-SP x 1350 LONG	1	EXISTING
4	DN375 STRAIGHT PIPE SO-SP x 1170 LONG	1	-
5	DN300 STRAIGHT PIPE FL-SO x 1025 LONG	1	-
6	DN375 MAGNETIC FLOW METER	1	EXISTING
7	DN375 DISMANTLING JOINT	1	EXISTING
8	DN375 STRAIGHT PIPE FL-FL x 900 LONG	1	EXISTING
9	DN375 GATE VALVE	1	EXISTING
10	DN375/DN400 ADAPTOR PLATE	1	SEE SKETCH
11	DN400 TABLE D S.O. FLANGE	1	-
12	DN400 x STD WT BLACK PIPE x 84 LONG	1	-
13	DN400 x STD WT LR 90° ELBOW	3	-
14	DN400 x STD WT BLACK PIPE x 800 LONG	1	TO BE CONFIRMED
15	DN400 x STD WT BLACK PIPE x 10 LONG	1	TO BE CONFIRMED

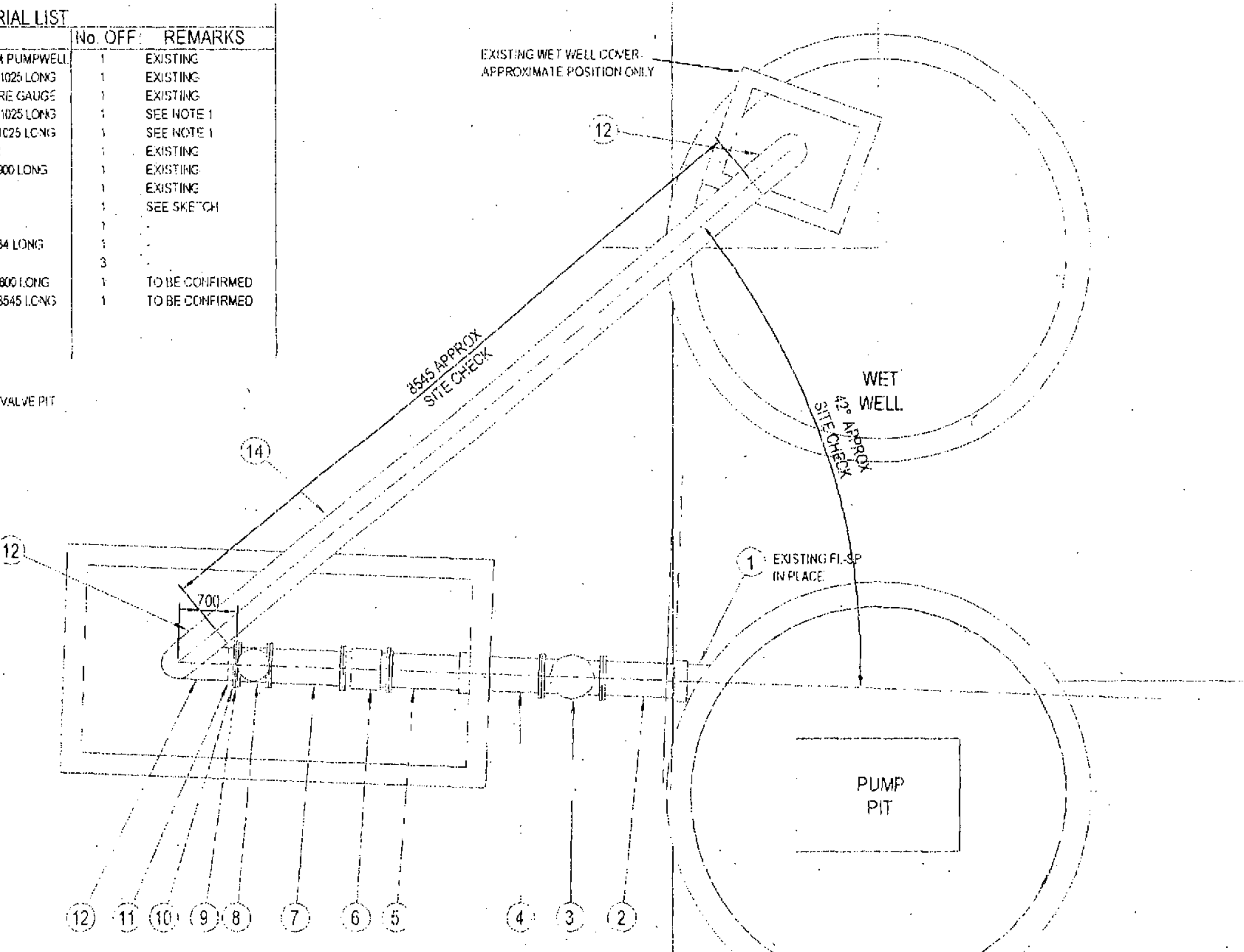


PLAN
SCALE 1:50

MATERIAL LIST

ITEM	DESCRIPTION	No. OFF	REMARKS
1	DN375 STRAIGHT PIPE SC FROM PUMPWELL	1	EXISTING
2	DN375 STRAIGHT PIPE FL-SC x 1025 LONG	1	EXISTING
3	DN375 FLANGED TEE - PRESSURE GAUGE	1	EXISTING
4	DN375 STRAIGHT PIPE FL-SC x 1025 LONG	1	SEE NOTE 1
5	DN300 STRAIGHT PIPE FL-SP x 1025 LONG	1	SEE NOTE 1
6	DN375 MAGNETIC FLOW METER	1	EXISTING
7	DN375 STRAIGHT PIPE FL-FL x 900 LONG	1	EXISTING
8	DN375 GATE VALVE	1	EXISTING
9	DN375/DN400 ADAPTOR PLATE	1	SEE SKETCH
10	DN400 TABLE D S.O. FLANGE	1	-
11	DN400 x STD WT BLACK PIPE x 84 LONG	1	-
12	DN400 x STD WT LR 90° ELBOW	3	-
13	DN400 x STD WT BLACK PIPE x 800 LONG	1	TO BE CONFIRMED
14	DN400 x STD WT BLACK PIPE x 8545 LONG	1	TO BE CONFIRMED

NOTE 1 PIPE AT NORTHERN END OF VALVE PIT



PLAN
SCALE 1:50

2.6 Procedures

2.6.1 Factory Acceptance Testing

The switchboard has been delivered to site and all FAT testings have been completed by MPA Engineering. Refer to Section 3. FACTORY ACCEPTANCE TESTING for testing procedures and completed test sheets.

2.6.2 Pre-Commissioning

All activities prior functional and pump performance tests are classed as "Pre-Commissioning". All mechanical and electrical installations by HVAC shall be tested. The following is a brief description of the activities involved:

1. **Hydrostatic Pressure Testing** – test for any leaks in the pumping system, ie. pipework, valves, pump seals, etc;
2. **Switchboard Pre-Commissioning SAT** – all tests prior to energising the switchboard and component test after energisation; test for insulation and resistance, earthing system, general wiring & inspection, point to point test of field wirings, component operational test after energisation;
3. **Variable Speed Drives Programming** – check and program parameters to ensure correct motor settings and correct communication between VSDs and control system, to meet functional specification;
4. **Pumps Pre-Commissioning Testing** – motor directional check, general inspection and checking of operation;
5. **Instrumentation Calibration and Commissioning** – on site calibration and commissioning of pressure transmitter and flowmeter by manufacturer;
6. **Brisbane Water Pre-Commissioning** – standard pre-commissioning acceptance testing conducted by Brisbane Water Network Control Systems, and may include I/O checks.

Refer to Section 4. PRE-COMMISSIONING for the procedures and test sheets for the above activities.

2.6.3 Commissioning

The following is a brief description of the activities that cover commissioning:

1. **Switchboard Functional Testing** – check functionality of the switchboard by testing every device to verify correct operation, all faults shall be simulated and indicated to the relevant PLC/RTU I/O point;
2. **Brisbane Water Site Acceptance Testing** – standard site acceptance testing conducted by Brisbane Water Network Control Systems to test pump station functionality;
3. **Pump Performance Testing** – verify pump performance by running pumps to various test points, and observe result matches pump curve;
4. **Harmonic Filter Commissioning** – commission harmonic filter and testing by recording of harmonics at various pump loads detailed in the specification, to prove the filter has the calculate effect on the harmonic portion of the VSD system.

Refer to Section 5. COMMISSIONING for the procedures and test sheets for the above activities.

2.7 Timeline

Below is an approximate order and duration of activities throughout commissioning.

COMMISSIONING ACTIVITIES	DATES
Factory Acceptance Testing	
• Switchboard FAT	*Completed (03/12/2004)*
Pre-Commissioning	
• Hydrostatic Pressure Testing	*18/07/2005*
• Switchboard Pre-Commissioning SAT	*13/07/2005 – 15/07/2005*
• Variable Speed Drives Programming	*19/07/2005*
• Pumps Pre-Commissioning Testing	*19/07/2005*
• Instrumentation Calibration and Commissioning	*20/07/2005*
• Brisbane Water Pre-Commissioning	*14/07/2005 – 15/07/2005*
Commissioning	
• Switchboard Functional Testing	*19/07/2005 – 21/07/2005*
• Brisbane Water Site Acceptance Testing	*19/07/2005 – 21/07/2005*
• Pump Performance Testing	*22/07/2005*
• Harmonic Filter Commissioning	*25/07/2005*
• Pump Draft Test Results Submission to BW	*26/07/2005*
• Remove Recirculating Piping After BW Review/Approve of Pump Draft Test Results	*28/07/2005*

2.8 Commissioning Inspection and Test Plan

< Commissioning ITP Attachment >

REDIRECTION OF HEROES AVENUE SEWAGE PUMP STATION (HEROES AVENUE) INSPECTION AND TEST PLAN COMMISSIONING	BRISBANE WATER – CONTRACT BW.30079-02/03 **HVAC/HPS QUEENSLAND PTY LTD** DOCUMENT NO. 3251Q-HEROES-COMMISSION-01 REVISION DATE: 27/06/05

LEGEND		ITP REVISION STATUS		
INSPECTION ACTIVITY	DEFINITIONS	REVISION DATE	ITEM NUMBERS REVISED	ISSUE STATUS
(I)	Visual Inspection	28/06/2005	1 to 10	Approval
(A)	Action			
(H) Hold Point	Work must not proceed until inspection activity has been carried out.			
(T) Third Party	Outside agency nominated by client or end user involvement			
(W) Witness Point	Work may proceed where inspection personnel are not available at the specified time.			
(M) Monitor	Monitor on a random basis would be visual or dimensional or exam. of records, etc.	COMPANY PROCEDURES		
(S) Send	Send documents to purchaser for approval.	P-001	MANAGING OUR SYSTEM	
(E) Examine	Examine and endorse records for compliance to Quality Plan	P-002	ESTIMATING	
ABBREVIATIONS	DEFINITIONS	P-003	LAUNCHING THE PROJECT	
WPS	Weld Procedure Specification	P-004	PROJECT IN PROGRESS	
WPQR	Weld Procedure Qualification Record	P-005	PROJECT WRAP UP	
NCR	Non Conformance Report	P-006	AFTER CARE	
SC	Subcontractor	P-007	REPORTING	
MDR	Manufacturers Data Report	P-008	PROCESS CONTROL	
JI	Job Instructions	P-010	TRAINING	
POA	Purchase Order Attachments (eg. Form 06a for ductwork)	P-012	AUDITING AND WORKPLACE INSPECTION	
REFERENCE DOCUMENTS		P-015	PLANT AND EQUIPMENT	
CODE	DEFINITION	P-016	PURCHASING	
C1	HVAC/HPS QLD Heroes Avenue Sewage Pump Station Commissioning Plan	P-021	DESIGN PROCEDURE	
C2	Brisbane Water Specification – Contract BW.30079-02/03	P-028	DRAFTING STANDARDS	
C3	Associated Brisbane Water Standard Specification	P-029	HANDLING STORAGE AND DELIVERY	
C4	Issued for Construction Drawings supplied for the project			

REDIRECTION OF HEROES AVENUE SEWAGE PUMP STATION (HEROES AVENUE) INSPECTION AND TEST PLAN COMMISSIONING	BRISBANE WATER – CONTRACT BW.30079-02/03 **HVAC/HPS QUEENSLAND PTY LTD** DOCUMENT NO. 3251Q-HEROES-COMMISSION-01 REVISION DATE: 27/06/05

SECT NO.	ACTIVITY	INSPECTION CRITERIA	ACCEPTANCE CRITERIA	CERTIFYING/ VERIFYING DOCUMENT	VERIFIED AND WITNESSED BY (INITIALED AND DATED)		COMMENTS
					HVAC/HPS QLD	BRISBANE WATER	
3.	Switchboard Factory Acceptance Testing	FAT Document	FAT completed and signed.	MPA Engineering FAT Inspection and Test Sheets	I	I	
4.1	Hydrostatic Pressure Testing	Hydrostatic Pressure Test Document	Testing completed and signed.	HVAC/HPS QLD Hydrostatic Pressure Test Sheets and Report (Form 15W, Form 90F)	A	H	
4.2	Switchboard Pre-Commissioning Site Acceptance Testing	SAT Document	SAT completed and signed.	Common Logic SAT Inspection and Test Sheets	I	H	
4.3	Variable Speed Drives Programming	Record of programmed parameters	VSDs programmed and recorded.	VSDs Parameters Record	A	I	
4.4	Pumps Pre-Commissioning Testing	Pumps Pre-commissioning Test Document	Pumps pre-commissioning completed and test sheets signed.	HVAC/HPS QLD Pumps pre-commissioning test sheets (Form 46K)	A	I	
4.5	Pressure Transmitter Calibration and Commissioning	Calibration Certifying Document	Pressure transmitter calibrated and certified on site by manufacturer.	Vega Factory & Site Calibration Certifying Documents	I	H	
4.5	Flowmeter Calibration and Commissioning	Calibration Certifying Document	Flowmeter calibrated and certified on site by manufacturer.	ABB Factory & Site Calibration Certifying Documents	I	H	
5.1	Switchboard Functional Testing	Functional Testing Document	Functional testing completed and test sheets signed.	HVAC/HPS QLD Functional Test Sheets	A	H	
5.2	Pump Performance Testing	Pump Performance Test Document	Pumps performed to client and manufacturer's specifications.	HVAC/HPS QLD Pump Performance Testing Records	A	H	
5.3	Harmonic Filter Commissioning	Harmonics Recording to C2	Harmonics Recorded under limits by AS 2279.2	ECO Commissioning Records and Report	I	H	

3. FACTORY ACCEPTANCE TESTING

3.1 Purpose

The switchboard shall be tested to ensure the requirements of the functional specification have been met. This shall include complete I/O testing from the PLC to all switchboard-based I/O and simulation of the operation of field I/O. The PLC and RTU software may also be tested by the principle.

3.2 Scope

Inspections and testings of the Heroes Avenue Pump Station switchboard were conducted during the month of November 2004 which included the PLC and RTU configurations and I/O testings by Brisbane Water, with the final inspection and FAT sign off occurring on 03/12/2004.

The following details the testing procedures conducted by MPA Engineering for FAT, followed by the associated test sheets certifying the results.

3.2 Procedures

< MPA Engineering Inspection and Test Sheets Attachment >

3 FAT

HEROES AVE PUMP STATION

INSPECTION AND TEST SHEETS

MSB

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Breakdown Service: 0411 221 446
ABN 77 011 069 533 A.C.N 011 069 533

Sunshine Coast Office
PO Box 5383 Caloundra D.C. 4551
Phone: 07 5491 7282 Fax: 07 5491 8777
Breakdown Service: 0411 221 446

PROJECT NO:	**7690**
DOCUMENT REF:	**7690 - ITS - V0_01**
CUSTOMER:	**HVAC / HPS**
AUTHOR:	**KAREN NEWTON**
EDITION NO. & DATE:	**V 0.01 / NOV 04**

CHECKED BY: .... **DATE:** ....

APPROVED BY: .... **DATE:** ....

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6. PLC Switchboard Check List For Electrical – Check GE-FANUC Wiring (3 pages)
7. PLC Switchboard Check List For Electrical – Check RTU I/O Wiring (2 pages)
8. Non Conformance Report (2 pages)

THE ENGINEERS, THE IDEAS, THE SOLUTIONS

SUNSHINE COAST BRANCH
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Authorised SIEMENS Distributor Citect Gold Integrator

ABN 77 011 069 533 ACN 011 069 533

HEAD OFFICE
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Engineering Pty Ltd
Specialists in Machine and Plant Automation

SWITCHBOARD TEST SHEET – MAJOR PROJECT

PROJECT H.V.A.C. JOB NUMBER 7690

DESCRIPTION HERO's Avenue Pump Station

DRAWING No.s ______ TEST DATE ______

Enclosure	N/R	ACC	N/A	Done/Comment
Inspect for damage and missing parts		✓		No Cathodic Protection
Paint correct colour, type and application		✓		
Check IP Rating		✓		
Check switchboard for level, vertical alignment and continuity of level between panels		✓		
Handles fitted to all lift off panels		✓		
All doors hinges screws tight		✓		
Door gasket fitted and secure		✓		
Door locks and 3 point closures smooth and tight		✓		
Gland plates fitted, correct material, earthed and gasket fitted if req.		✓		
Check tightness of plinth to board		✓		
Electrical fit out				
Correct torque rating of power cables and busbar bolts		✓		
Busbar torqued connections marked		✓		
Busbar insulation fitted as required		✓		
All wire colours correct and as per spec		✓		
Tightness of cables and wire terminations		✓		
Continuity of earth on all points				
Doors with control equipment earthed		✓		
Check all earth connections are correct and are connected to earth bar or grid		✓		
6mm SDI fitted to Line side of control fuses for high fault level takeoffs		✓		
Check cable size against cable schedule or rating of CB.		✓		
Surge arrestor line side cabling size and insulation		✓		
Circuit breaker chassis has nominated spare capacity		✓		
CT secondaries earthed.		✓		
Check contactors, thermals, circuit breakers are correct for particular operation		✓		
Check fuse holders for damage, fuses for continuity and correct rating		✓		
All indicators and pushbuttons correct colour and bulbs fitted				
All clearances in accordance with AS3000		✓		
Ammeters and selectors correct size, operation and CT matched		NA		
Voltmeters and selectors correct		NA		
All equipment mounted correctly, square and secure		✓		
All control wiring ferruled as required		✓		

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Electrical fit out continued	N/R	ACC	N/A	Done/Comment
All control wiring numbered		✓		
Wiring looms to doors incorporates suitable slack		✓		
Label colour, sizes and material correct				
All labels screwed		✓		
All relays labelled		✓		
All control terminal numbers fitted		✓		
All protective covers in place		✓		
All duct lid fitted		✓		
All pole fillers fitted		✓		
Circuit card holder fitted to all DB sections				
Ventilation fans filter material fitted and not fouling.		✓		
Neutral & Earth bar screws provided and tight in link		✓		
All neutral bar connections numbered.		✓		
All earth bar connections numbered		✓		
Bolts provided in earth and neutral bars		✓		
Bolts and screws fitted to incoming terminations		✓		
Lighting operation and door limit switches		✓		
Neutral and earth terminations provided for largest incoming cable		✓		
Point to point wiring check completed		✓		

Electrical operation	N/R	ACC	NA	Done / Comment
Isolate control circuits, turn on all CB'S, isolators Place fuse links in carriers. *Surge arrestor earth to be disconnected* *Disconnect all electronic equipment.*				
Megger power circuits and record on separate Insulation Test Record sheet		✓		
Operate each device (Switch, C/B, Contactor, Overload etc). for correct operation.		✓		
Shunt tripping correct			✓	No Shunt trip
All indicating lights operational		✓		
Check mechanical interlocks and freedom of operation of electrical switches.			✓	
Check Operation of key interlocks where installed		✓		
Check phasing of all incoming and outgoing circuits		✓		
TOL trips contactor and fault light indication		✓		
Hours run meter operates		✓		
Ammeter load test – all phases			✓	
Voltmeter test – all phases			✓	
TOL reset coils operate		✓		
Contactor operation quiet		✓		
Control circuit full function test		✓		
VSD Operation Checklist completed for each drive		✓		
Electrical Final				
MPA Nameplate / Rating plate fitted		✓		
Time clock battery reserve operates		✓		
Timers set to correct time range		✓		

Electrical- Final continued	N/R	ACC	NA	Done / Comment
TOL set to correct motor current if known. If unknown, set to minimum		✓		
Time clock setting correct or to OFF			✓	
Ammeter and voltmeter, zero adjusted.			✓	
Wire numbers are correct to drawing			✓	
Marked up / As Constructed copy of the drawings placed in board			✓	
All tools and spares provided and packed			✓	
Vacuum and touch up paintwork.			✓	
Photos taken			✓	

NCR / Remedial Action Required

Testing Officer K. Newton Signature [signature] Date 19.11.04

Completed Product
Verified by MPA ______________ ______________ Date ______
(Print Name) (Signature)

Page 3 of 3

FORM F17/ Revised 9/04
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Specialists in Machine and Plant Automation

SWITCHBOARD INSULATION TEST REPORT

PROJECT H.VAC JOB NUMBER 7690

DESCRIPTION Hero's Avenue Pump station.

DRAWING No.s ______________________ TEST DATE ________

INCOMER / BUSBAR					
DATE: 11-11-07		MEGGER SERIAL NUMBER:			
RED – EARTH	✓	WHITE – EARTH	✓	BLUE – EARTH	✓
RED – NEUTRAL	✓	WHITE – NEUTRAL	✓	BLUE – NEUTRAL	✓
RED – WHITE	✓	WHITE – BLUE	✓	BLUE – RED	✓

LOAD CIRCUITS					
DATE:		MEGGER SERIAL NUMBER:			
CIRCUIT ONE: Pump 1					
RED – EARTH	✓	WHITE – EARTH	✓	BLUE – EARTH	✓
RED – NEUTRAL	✓	WHITE – NEUTRAL	✓	BLUE – NEUTRAL	✓
RED – WHITE	✓	WHITE – BLUE	✓	BLUE – RED	✓
CIRCUIT TWO: Pump 2					
RED – EARTH	✓	WHITE – EARTH	✓	BLUE – EARTH	✓
RED – NEUTRAL	✓	WHITE – NEUTRAL	✓	BLUE – NEUTRAL	✓
RED – WHITE	✓	WHITE – BLUE	✓	BLUE – RED	✓
CIRCUIT THREE: Pump 3					
RED – EARTH	✓	WHITE – EARTH	✓	BLUE – EARTH	✓
RED – NEUTRAL	✓	WHITE – NEUTRAL	✓	BLUE – NEUTRAL	✓
RED – WHITE	✓	WHITE – BLUE	✓	BLUE – RED	✓
CIRCUIT FOUR: DB					
RED – EARTH	✓	WHITE – EARTH	✓	BLUE – EARTH	✓
RED – NEUTRAL	✓	WHITE – NEUTRAL	✓	BLUE – NEUTRAL	✓
RED – WHITE	✓	WHITE – BLUE	✓	BLUE – RED	✓
CIRCUIT FIVE: Harmonic Filter					
RED – EARTH	✓	WHITE – EARTH	✓	BLUE – EARTH	✓
RED – NEUTRAL	✓	WHITE – NEUTRAL	✓	BLUE – NEUTRAL	✓
RED – WHITE	✓	WHITE – BLUE	✓	BLUE – RED	✓
CIRCUIT SIX: Common controls					
RED – EARTH	✓	WHITE – EARTH	✓	BLUE – EARTH	✓
RED – NEUTRAL	✓	WHITE – NEUTRAL	✓	BLUE – NEUTRAL	✓
RED – WHITE	✓	WHITE – BLUE	✓	BLUE – RED	✓
PLEASE LABEL CIRCUITS BY WAY OF MOTOR NAME OR FUNCTION					
Testing Officer K. Ne___ Signature ______ Date 11-11-04					

Completed Product
Verified by MPA ____________ ____________ Date ________
(Print Name) (Signature)

FORM F18/ Revised 10/04
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VSD SWITCHBOARD CHECK LIST FOR ELECTRICAL

PROJECT _Heroes Ave___ PROJECT ENGINEER___Karen Newton____

DESCRIPTION __VSD Pump 1

DRAWING NUMBERS __0203-E102 DATE ___15/11/04

No	DESCRIPTION	O.K.	N/A	COMMENTS
1	**Visual Inspection**	✓		
1.1	Control Fuse / MCB Size ______ VAC	✓		
1.2	Contactor Mechanical Operation	✓		
1.3	Overload Size Confirmed	✓		
1.4	Meter Range Confirmed	~~✓~~	✓	
1.5	Door Interlock Operation	✓		
1.6	Point to Point VSD Analog Input and Output Wiring to Terminal Strip	✓		
1.7	Connect 3 Phase Motor	✓		
2	**Functional Testing**			
	Simulator interface to be connected and tests performed as detailed below			
2.1	With module circuit breaker on program variable speed drive	✓		
2.2	Confirm control power available pilot light operation	✓		
2.3	Confirm main contactor relay operation if applicable	✓		
2.4	Confirm Main contactor Operation	✓		
2.5	Confirm motor run pilot light operation (if applicable)	✓		
2.6	Confirm module ventilation fan operation and direction	✓		
2.7	Confirm fault relay or indication operation at fault situation	✓		
2.8	Confirm VSD run Status	✓		
2.9	Confirm VSD ready status	✓		
2.10	Confirm VSD running speed reference	✓		
2.11	With the selector switch in Local Position operate the VSD and adjust the speed via the door mounted keypad or potentiometer	✓		
2.12	Simulate VSD Fault by opening VSD bridge between enable terminals	✓		
2.13	Confirm VSD Reset relay operation with reset button	✓		
2.14	Confirm temperature if applicable	✓		
3	**Miscellaneous**			
3.1	Random check of C.B, VSD and Contactor torque	✓		
3.2	Control cable colour and sizes checked	✓		
3.3	Power cables colour and size checked	✓		
3.4	Terminal ID tags installed	✓		
3.5	Terminal Numbers Installed	✓		
3.6	Module Labels correctly installed	✓		
3.7	Current transformers earthed	✓		

Checked by K. Newton
(Print Name)

Signature

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VSD SWITCHBOARD CHECK LIST FOR ELECTRICAL

PROJECT _Heroes Ave___ PROJECT ENGINEER___Karen Newton____

DESCRIPTION __VSD Pump 2

DRAWING NUMBERS __0203-E103 DATE ___15/11/04

No	DESCRIPTION	O.K.	N/A	COMMENTS
1	**Visual Inspection**	✓		
1.1	Control Fuse / MCB Size ______VAC	✓		
1.2	Contactor Mechanical Operation	✓		
1.3	Overload Size Confirmed		✓	
1.4	Meter Range Confirmed		✓	
1.5	Door Interlock Operation	✓		
1.6	Point to Point VSD Analog Input and Output Wiring to Terminal Strip	✓		
1.7	Connect 3 Phase Motor	✓		
2	**Functional Testing**			
	Simulator interface to be connected and tests performed as detailed below	✓		
2.1	With module circuit breaker on program variable speed drive	✓		
2.2	Confirm control power available pilot light operation	✓		
2.3	Confirm main contactor relay operation if applicable	✓		
2.4	Confirm Main contactor Operation	✓		
2.5	Confirm motor run pilot light operation (if applicable)	✓		
2.6	Confirm module ventilation fan operation and direction	✓		
2.7	Confirm fault relay or indication operation at fault situation	✓		
2.8	Confirm VSD run Status	✓		
2.9	Confirm VSD ready status	✓		
2.10	Confirm VSD running speed reference	✓		
2.11	With the selector switch in Local Position operate the VSD and adjust the speed via the door mounted keypad or potentiometer	✓		
2.12	Simulate VSD Fault by opening VSD bridge between enable terminals	✓		
2.13	Confirm VSD Reset relay operation with reset button	✓		
2.14	Confirm temperature if applicable	✓		
3	**Miscellaneous**			
3.1	Random check of C.B, VSD and Contactor torque	✓		
3.2	Control cable colour and sizes checked	✓		
3.3	Power cables colour and size checked	✓		
3.4	Terminal ID tags installed	✓		
3.5	Terminal Numbers Installed	✓		
3.6	Module Labels correctly installed	✓		
3.7	Current transformers earthed	✓		

Checked by K Newton
(Print Name)

Signature

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VSD SWITCHBOARD CHECK LIST FOR ELECTRICAL

PROJECT _Heroes Ave___ PROJECT ENGINEER___Karen Newton____

DESCRIPTION __VSD Pump 3___________________________________

DRAWING NUMBERS __0203-E104____________________ DATE ___15/11/04

No	DESCRIPTION	O.K.	N/A	COMMENTS
1	**Visual Inspection**			
1.1	Control Fuse / MCB Size ______VAC	✓		
1.2	Contactor Mechanical Operation	✓		
1.3	Overload Size Confirmed	✗	✓	
1.4	Meter Range Confirmed		✓	
1.5	Door Interlock Operation	✓		
1.6	Point to Point VSD Analog Input and Output Wiring to Terminal Strip	✓		
1.7	Connect 3 Phase Motor	✓		
2	**Functional Testing**	✓		
	Simulator interface to be connected and tests performed as detailed below			
2.1	With module circuit breaker on program variable speed drive	✓		
2.2	Confirm control power available pilot light operation	✓		
2.3	Confirm main contactor relay operation if applicable	✓		
2.4	Confirm Main contactor Operation	✓		
2.5	Confirm motor run pilot light operation (if applicable)	✓		
2.6	Confirm module ventilation fan operation and direction	✓		
2.7	Confirm fault relay or indication operation at fault situation	✓		
2.8	Confirm VSD run Status	✓		
2.9	Confirm VSD ready status	✓		
2.10	Confirm VSD running speed reference	✓		
2.11	With the selector switch in Local Position operate the VSD and adjust the speed via the door mounted keypad or potentiometer	✓		
2.12	Simulate VSD Fault by opening VSD bridge between enable terminals	✓		
2.13	Confirm VSD Reset relay operation with reset button	✓		
2.14	Confirm temperature if applicable	✓		
3	**Miscellaneous**			
3.1	Random check of C.B, VSD and Contactor torque	✓		
3.2	Control cable colour and sizes checked	✓		
3.3	Power cables colour and size checked	✓		
3.4	Terminal ID tags installed	✓		
3.5	Terminal Numbers Installed	✓		
3.6	Module Labels correctly installed	✓		
3.7	Current transformers earthed	✓		

Checked by K Newton (Print Name)   Signature

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PLC SWITCHBOARD CHECK LIST FOR ELECTRICAL

PROJECT _Heroes Ave______ PROJECT MANAGER___Karen Newton____

DESCRIPTION ___Check GE FANUC wiring ________________________

DRAWING NUMBERS __0203-E101 – E121______________ DATE ____5/11/04________

No	DESCRIPTION			O.K.	N/A	COMMENTS
1	**Method**					
1.1	Install Cable ID Sleeve to Each Conductor			✓		
1.2	Complete all terminations as per the drawings			✓		
1.3	Place all local / remote selector switches in the local position			✓		
1.4	Point to point test each conductor using audible setting on multimeter from PLC Card to terminals			✓		
1.5	Check all screened cable is terminated correctly and earthing is grounded on one side only (terminal block)			✓		
1.5	Mark as tested conductors on drawings			✓		
2	**Point to Point Testing**					
2.1	Slot 2 – IC693CMM311 MODBUS CARD			✓		
	Check modbus cable					
2.2	Slot 3 – IC693MDL645 16 POINT DIGITAL INPUT CARD					
	Input	**Component**	**Destination**			
	DI1-01	S1	Pump station remote selected	✓		
	DI1-02	SIR	Wet well surcharge imminent	✓		
	DI1-03	PFR2-1	Site power on		✓	Deleted - Moved to RDI1-15
	DI1-04	4K2 – 1	Sump Pump fault	✓		
	DI1-05	4K1 – 4	Sump Pump running	✓		
	DI1-06	MTR1-1	Dry Well Flooded – Alarm	✓		
	DI1-07	MTR2-1	Dry Well Flooded – Interlock	✓		
2.3	Slot 4 - IC693MDL645 16 POINT DIGITAL INPUT CARD					
	Input	**Component**	**Destination**			
	DI2-01	1K1-1	Pump 1 power on	✓		
	DI2-02	FIELD	Reflux Valve Microswitch	✓		
	DI2-03	1S3	Pump Start	✓		
	DI2-04	1S2	Pump Stop	✓		
	DI2-05	1K2-1	Emergency Stop	✓		
	DI2-06	1K7-1	VFD Auto	✓		
	DI2-07	READY	VFD Ready	✓		
	DI2-08	RESET	Local Reset	✓		
	DI2-09	RUNNING	Pump Running	✓		
	DI2-10	1K6-LOW	Moisture in Oil	✓		
2.4	Slot 5 - IC693MDL645 16 POINT DIGITAL INPUT CARD					
	Input	**Component**	**Destination**			
	DI3-01	2K1-1	Pump 2 power on	✓		

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	DI3-02	FIELD	Reflux Valve Microswitch	✓		
	DI3-03	2S3	Pump Start	✓		
	DI3-04	2S2	Pump Stop	✓		
	DI3-05	2K2-1	Emergency Stop	✓		
	DI3-06	2K7-1	VFD Auto	✓		
	DI3-07	READY	VFD Ready	✓		
	DI3-08	RESET	Local Reset	✓		
	DI3-09	RUNNING	Pump Running	✓		
	DI3-10	2K6-LOW	Moisture in Oil	✓		
2.5	Slot 6 - IC693MDL645 16 POINT DIGITAL INPUT CARD					
	Input	**Component**	**Destination**			
	DI4-01	3K1-1	Pump 2 power on	✓		
	DI4-02	FIELD	Reflux Valve Microswitch	✓		
	DI4-03	3S3	Pump Start	✓		
	DI4-04	3S2	Pump Stop	✓		
	DI4-05	3K2-1	Emergency Stop	✓		
	DI4-06	3K7-1	VFD Auto	✓		
	DI4-07	READY	VFD Ready	✓		
	DI4-08	RESET	Local Reset	✓		
	DI4-09	RUNNING	Pump Running	✓		
	DI4-10	3K6-LOW	Moisture in Oil	✓		
2.6	Slot 7 – IC693MDL940 16 POINT DIGITAL OUTPUT CARD					
	Output	**Component**	**Destination**			
	DO1-01	1H2	Pump 1 status	✓		
	DO1-02	1K3	Pump 1 run	✓		
	DO1-03	1K4	Pump 1 Fault reset	✓		
	DO1-04	1K5	Pump 1 run at max speed	✓		
	DO1-05	2H2	Pump 2 status	✓		
	DO1-06	2K3	Pump 2 run	✓		
	DO1-07	2K4	Pump 2 Fault reset	✓		
	DO1-08	2K5	Pump 2 run at max speed	✓		
	DO1-09	3H2	Pump 3 status	✓		
	DO1-10	3K3	Pump 3 run	✓		
	DO1-11	3K4	Pump 3 Fault reset	✓		
	DO1-12	3K5	Pump 3 run at max speed	✓		
2.7	Slot 8 – IC693ALG221 4 CHANNEL ANALOGUE INPUT CARD					
	Input	**Component**	**Destination**			
	AI1-01	AI01-L2	Wet Well Level Indicator	✓		
	AI1-02	AI1-02P	Pipe Pressure Transmitter	✓		
	AI1-03	AI1-03	Flow Meter			Not Connected Yet
2.8	Slot 9 – IC693ALG221 4 CHANNEL ANALOGUE INPUT CARD					
	Input	**Component**	**Destination**			
	AI2-05	VSD 1	Motor Speed	✓		
	AI2-06	VSD 2	Motor Speed	✓		
	AI2-07	VSD 3	Motor Speed	✓		
3.0	Slot 10 – IC693ALG 8 CHANNEL ANALOGUE OUTPUT CARD					
	Output	**Component**	**Destination**			

	AO01	VSD 1	Motor Speed Reference	✓		
	AO02	VSD 2	Motor Speed Reference	✓		
	AO03	VSD 3	Motor Speed Reference	✓		

Checked by Karen Newton
(Print Name)

Signature

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PLC SWITCHBOARD CHECK LIST FOR ELECTRICAL

PROJECT _Heroes Ave______ PROJECT MANAGER___Karen Newton____

DESCRIPTION ___Check RTU I/O wiring ______________________

DRAWING NUMBERS __0203-E101 – E121______________ DATE ____5/11/04_______

No	DESCRIPTION			O.K.	N/A	COMMENTS
1	**Method**					
1.1	Install Cable ID Sleeve to Each Conductor			✓		
1.2	Complete all terminations as per the drawings			✓		
1:3	Place all local / remote selector switches in the local position			✓		
1.4	Point to point test each conductor using audible setting on multimeter from PLC Card to terminals			✓		
1.5	Check all screened cable is terminated correctly and earthing is grounded on one side only (terminal block)			✓		
1.5	Mark as tested conductors on drawings			✓		
2	**Point to Point Testing**					
2.1	Digital Input Module 1					
	Input	**Component**	**Destination**			
	RDI1/11	Fault Ind.	Harmonic Filter	✓		
	RDI1/12	S5	Site Attention Alarm	✓		
	RDI 1/15	PFR 2-2	Site Mains Manual	✓		
2.2	Digital Input Module 2					
	Input	**Component**	**Destination**			
	RDI2/28	RTU	RTU Power	✓		
	RDI2/29	Surge Alarm	Surge Diverter Alarms	✓		
2.3	Digital Input Module 3					
	Input	**Component**	**Destination**			
	DI3-32	Generator	Generator Fault	✓		
	DI3-33	Generator	Generator Warning	✓		
	DI3-34	Generator	Generator low fuel	✓		
	DI3-35	Generator	Generator Running	✓		
	DI3-36	Generator	Generator Connected	✓		
	DI3-37	Mains Power	Energex Power Fail	✓		
	DI3-38	Generator	Generator Security	✓		
	DI3-39	Generator	Generator CB Status	✓		
	DI3-40	Generator	Generator Mode	✓		
	DI3-41	Generator	Generator On Site	✓		
	DI3-42	Mains Power	Mains Incomer CB Closed	✓		
	DI3-45	24VDC	Battery System O.k	✓		
2.4	Digital Output Module 1					
	Output	**Component**	**Destination**			
2.5	Digital Output Module 2					
	Output	**Component**	**Destination**			
	DO2-08	GRST	Generator Start	✓		
	DO2-09	GRSP	Generator Stop	✓		
	DO2-11	WWWR	Wet Well Washing Relay	✓		
	DO2-12	SITE ATTN	Site Attention Alarm	✓		

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	DO2-13	BC	RTU – Battery Check	✓		
2.6	Analogue Input					
	Input	**Component**	**Destination**			
	AI01+	WWWR	Wet Well Washing relay	✓		

Checked by K Newton (Print Name) Signature

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NON CONFORMANCE REPORT

PROJECT: __Heroes Ave Pump Station_____ ENGINEER: ____________
CLIENT: __HVAC /HPS______________ CONTACT: ____________
JOB NO: ___7690__________________ PHONE NO: ____________
DESCRIPTION: _Construct one MSB for Heroes Ave as directed by BW________________

DRAWING NUMBER	ISSUE / REVISION NO.	NON CONFORMANCE REPORT NO ____ DATE: ___/___/___

DESCRIPTION AND REASON FOR NON CONFORMANCE:

MCBR-3 Not Wired
QCBR-3 Not Wired
Redo Lable 'Surge' 2 GFR's 'not needed
Swap 7, 8 on 'MTR'
Swap Pump 1 with Pump 3 Vise versa
Move PTR2 to RTU

INSPECTED BY: ____________ DATE___/___/___

RECOMMENDED ACTION PROPOSED BY:____________

REWORK / REPAIR ☐ APPLY FOR CONCESSION TO USE ☐

RETURN TO SUPPLIER ☐ SCRAP ☐

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Breakdown Service: 0411 221 446

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Citect Gold Integrator

HEAD OFFICE
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Brendale QLD 4500
Phone: 07 3881 0722 Fax: 07 3881 0723
A/H: 0411 221 446

RE-INSPECTED BY: ____________________________ DATE ____ / _____ / _____

REWORK / REPAIR ☐ APPLY FOR CONCESSION TO USE ☐

RETURN TO SUPPLIER ☐ SCRAP ☐

QUALITY OFFICER COMMENTS : ____________________________

SIGNATURE : ______________________ DATE : _____ / _____ / _____

FORM F31

F:\Admin\QUALITY\Quality revised 2003\Switchboard Inspection Forms\QUALITY REJECTION REPORT.doc

4.1

HYDRO

4. PRE-COMMISSIONING

4.1 Pipework Hydrostatic Pressure Testing

4.1.1 Purpose

Testing of mechanical installations by HVAC for pressure losses (ie. pipework, valves, pump seals, etc...)

4.1.2 Scope

2 hydrostatic pressure tests:

1. Pumps to end of header
2. Valve pit section

Refer to attached drawings of pipework area map.

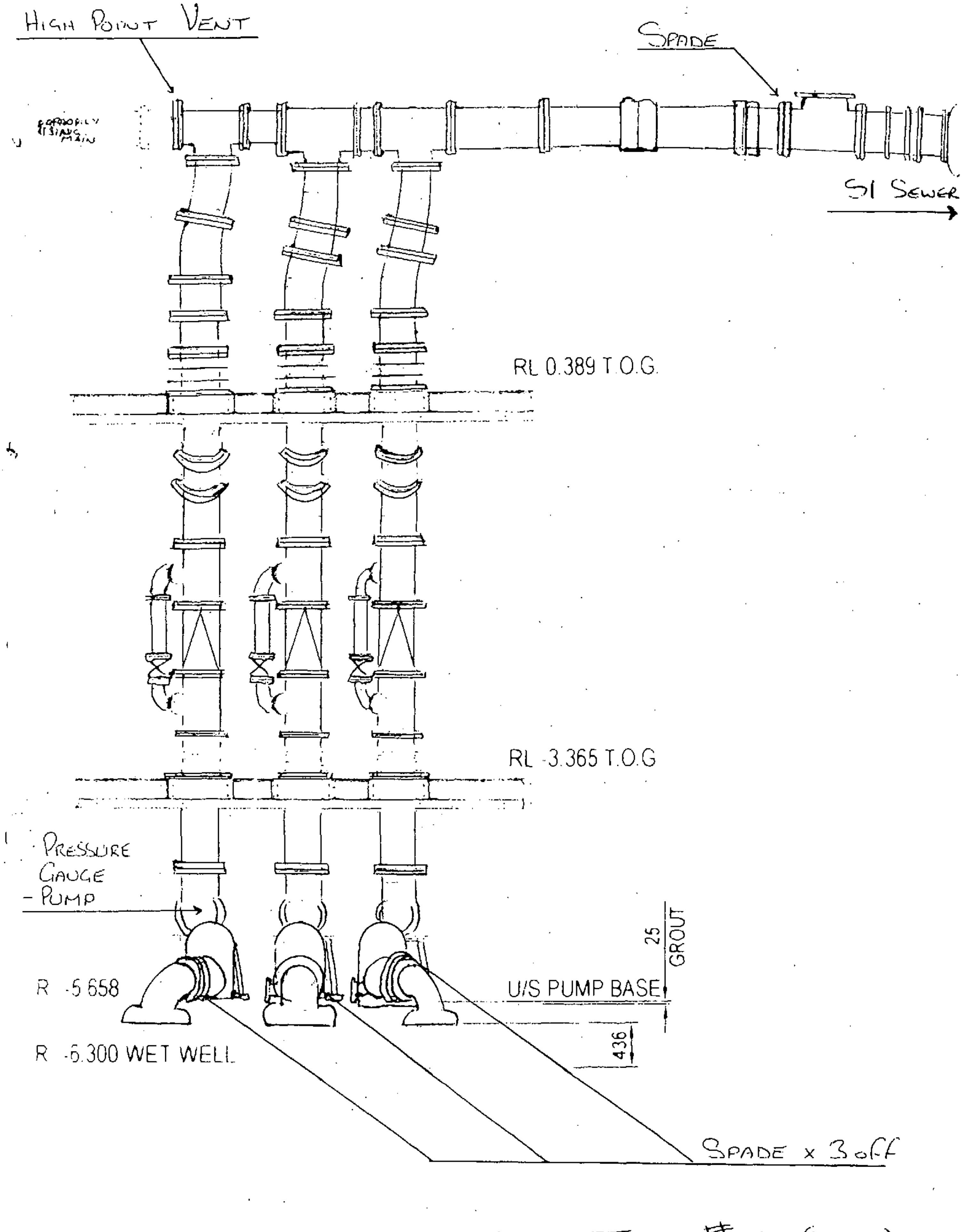
The testing pressure to be 90m.

4.1.3 Procedures

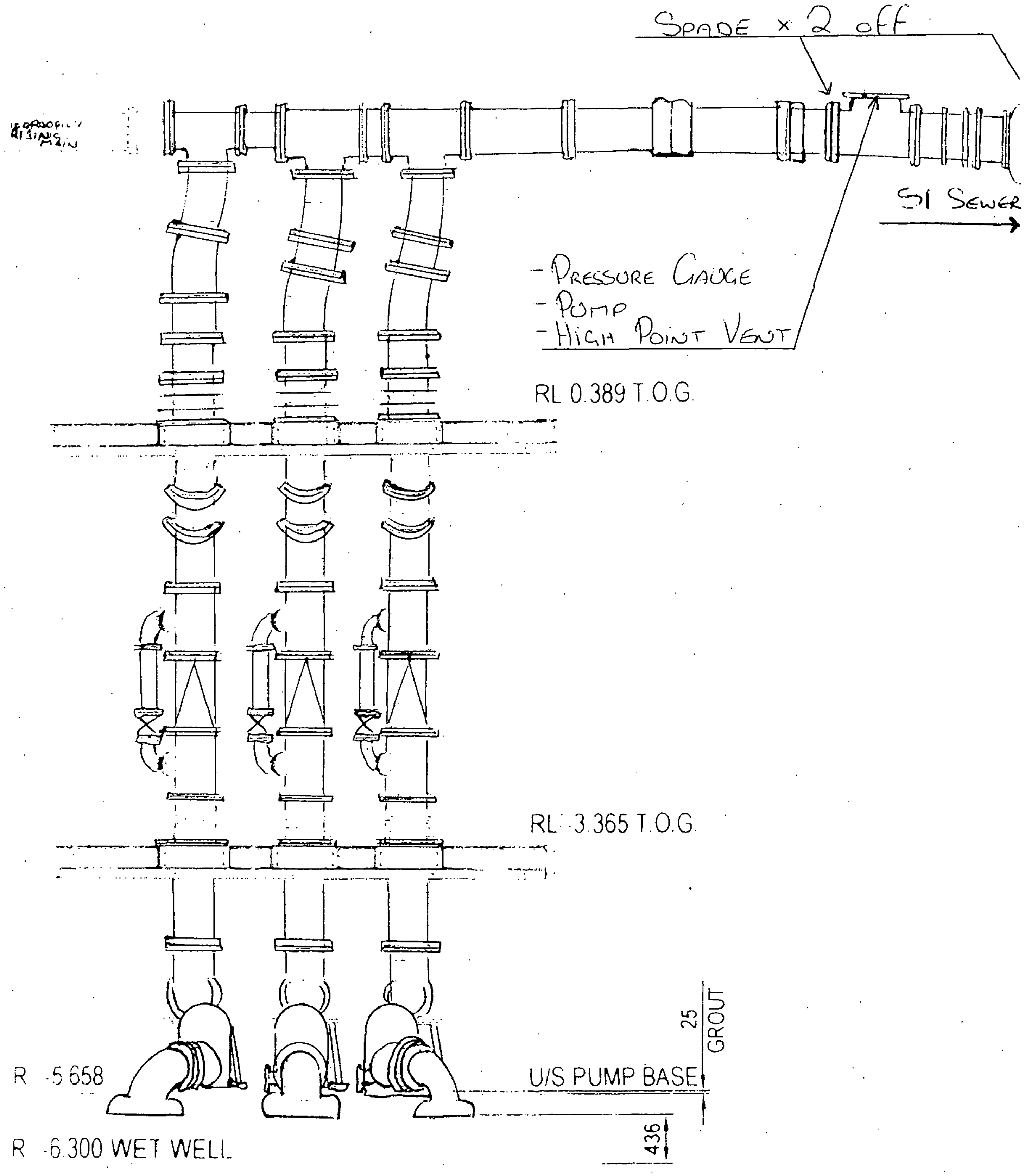
1. Complete Pre Hydro and Post Hydro test sheets (HVAC Form 15W)
2. Document results in Hydrostatic Pressure Test Report (HVAC Form 90F)

< Pipework Area Map Drawings Attachment >

< Test Sheets and Report Attachment >



HYDRO TEST # 1 (DETAIL)



HYDRO TEST #2 (DETAIL)

HVAC

PIPING CHECKLIST – PRE HYDRO

hps

Project : Heroes Avenue Sewage Pump Station	Inspected By: Rene Bongers	SITE:
Line No./Test Pack No.:	Area	
Equipment Description		

Item No.	Item Description	Checked by HVAC/HPS	
		Initial	Date
1.	Installed to P&ID		
2.	Materials correct		
3.	Supports/Guides/Anchors correct		
4.	Spring hangers blocked/ removed		
5.	Temporary supports installed		
6.	Checked for external damage		
7.	NDT complete and satisfactory		
8.	PWHT complete and satisfactory		
9.	Control valves removed		
10.	Check valves/ internals removed (refer to register)		
11.	Expansion joints removed and/or restrained		
12.	Orifice plates removed YES/NO		
13.	Instrument process piping disconnected		
14.	Pre-testing flushing		
15.	In-line strainers installed (refer to register)		
16.	Blanks and spades installed		
17.	Vents open for filling		
18.	Test medium		
19.	Welds and fittings wrapped for underground service		
20.	Holiday test satisfactory		
21.	Trench backfilled and compacted		

Comments

CHECKED BY: (NAME)	
APPROVED BY : **(HVAC Representative)** Date:	APPROVED BY: (Client's Representative) Date:

PIPING CHECKLIST – POST HYDRO

HVAC

Project : Heroes Avenue Sewage Pump Station	Inspected By: Rene Bongers	SITE:
Line No./Test Pack No.:	Area	
Equipment Description		

Item No.	Item Description	Checked by HVAC/HPS	
		Initial	Date
1.	Test satisfactory completed		
2.	Flushing satisfactory completed		
3.	In-line strainers reinstated (refer to register)		
4.	Test blanks and spades removed		
5.	Temporary supports removed		
6.	Expansion joint restraints removed, joints installed		
7.	Control valves installed		
8.	Check valves/ internals reinstated (refer to register)		
9.	Orifice plates installed		
10.	Spring hangers unblocked and set and/or installed		
11.	Replacement gaskets installed		
12.	Vent/ Drain couplings plugged/ welded		
13.	Instrument process piping re-connected		
14.	Instrument installed		
15.	Steam tracing installed		
16.	Insulation complete		
17.	Painting and/or identification complete		
18.	Re-instated to P&ID		

Comments

CHECKED BY: (NAME)	
APPROVED BY : Date: (HVAC Representative)	APPROVED BY: Date: (Client's Representative)

HVAC

hps

HYDROSTATIC / PNEUMATIC PRESSURE TEST REPORT

ROJECT: Heroes Avenue Sewage Pump Station	**PROJECT NO.:** 3251Q
CLIENT: Brisbane Water	**TEST DATE:**
LOCATION/AREA:	

TEST SECTION DATA	
LOCATION	
TEST MEDIUM	
VOLUME	
HIGH POINT	
LOW POINT	
GAUGE POINT	

TEST SECTION I.D

PRESSURE RATING OF EQUIPMENT IN TEST SECTION		
ITEM	TAG NO	RATING M.A.O.P KPa

TEST EQUIPMENT DATA				
DESCRIPTION	MAKE	SERIAL NO	CALIBRATED BY	DATE
PRESSURE GAUGE				
PRESSURE RECORDED				
AMB.TEMP. RECORDER				
AMB. THERMOMETER				

PRESSURISING DATE		
TIME	PRESSURE KPa	AMB. TEMP. °C

STRENGTH TEST DATA		
TIME	PRESSURE KPa	AMB. TEMP. °C

LEAK TEST DATE		
TIME	PRESSURE KPa	AMB. TEMP. °C

Supervisor report:

TESTED BY: (NAME & SIGNATURE)	**WITNESSED BY: (NAME & SIGNATURE)**

HVAC

hps

HYDROSTATIC / PNEUMATIC PRESSURE TEST REPORT

PROJECT: Heroes Avenue Sewage Pump Station	**PROJECT NO.:** 3251Q
CLIENT: Brisbane Water	**TEST DATE:** 29-7-05
LOCATION/AREA: Heroes Ave Taringa SP-No-103	

TEST SECTION DATA		**TEST SECTION I.D.**
LOCATION	WetWell/DryWell/ValvePit	ME 007
TEST MEDIUM	Water	
VOLUME	≈ 3000 Litres	
HIGH POINT	As Per Sketch	
LOW POINT	As Per Sketch	
GAUGE POINT	As Per Sketch	

PRESSURE RATING OF EQUIPMENT IN TEST SECTION

ITEM	TAG NO.	RATING M.A.O.P.KPa
Pump ①	182521	600 KPA
Pump ②	182523	600 KPA
Pump ③	182522	600 KPA

TEST EQUIPMENT DATA

DESCRIPTION	MAKE	SERIAL NO.	CALIBRATED BY	DATE
PRESSURE GAUGE	Wikai	69911	Aust Calib Serv	28-7-05
PRESSURE RECORDED	—			
AMB.TEMP. RECORDER	—			
AMB. THERMOMETER	22° C			

PRESSURISING DATE

TIME	PRESSURE KPa	AMB. TEMP. °C
3.00	900	22° C
3.30	788	22° C

STRENGTH TEST DATA

TIME	PRESSURE KPa	AMB. TEMP. °C

LEAK TEST DATE

TIME	PRESSURE KPa	AMB. TEMP. °C
	16 bottles	
	≈ 8 litres	

Test failed to assess leakage rate in Pump3 Suction line - Pump 1 suction line appears ok. Remaining pipework is visually dry

Supervisor report: I AGREE WITH COMMENTS

TESTED BY: (NAME & SIGNATURE) [signature]

WITNESSED BY: (NAME & SIGNATURE) Michael Heritage [signature]

HVAC

PIPING CHECKLIST – PRE HYDRO

hps

Project : Heroes Avenue Sewage Pump Station		Inspected By: Rene Bongers	SITE: HEROES AVE
Line No./Test Pack No.: ME-007		Area HEROES AVE TARINGA SP No. 103 WET WELL / DRY WELL / VALVE PIT	
Equipment Description WASTE WATER PIPING / PUMPS / VALVES & HEADER			

Item No.	Item Description	Checked by HVAC/HPS	
		Initial	Date
1.	Installed to P&ID	RB	29-7-05
2.	Materials correct		
3.	Supports/Guides/Anchors correct		
4.	Spring hangers blocked/ removed		
5.	Temporary supports installed		
6.	Checked for external damage		
7.	NDT complete and satisfactory	NA	
8.	PWHT complete and satisfactory	NA	
9.	Control valves removed	NA	
10.	Check valves/ internals removed (refer to register)	By PASSED	
11.	Expansion joints removed and/or restrained	NA	
12.	Orifice plates removed YES/NO	NA	
13.	Instrument process piping disconnected	NA	
14.	Pre-testing flushing	RB	
15.	In-line strainers installed (refer to register)	NA	
16.	Blanks and spades installed	RB	
17.	Vents open for filling	RB	
18.	Test medium	WATER	
19.	Welds and fittings wrapped for underground service	NA	
20.	Holiday test satisfactory	RB	
21.	Trench backfilled and compacted	NO	

Comments

CHECKED BY: (NAME) René Bongers	
APPROVED BY : (HVAC Representative) Date: 29-7-05	APPROVED BY: (Client's Representative) Date:

HVAC

hps

HYDROSTATIC / PNEUMATIC PRESSURE TEST REPORT

PROJECT: Heroes Avenue Sewage Pump Station | **PROJECT NO.:** 3251Q

CLIENT: Brisbane Water | **TEST DATE:** 4-8-05

LOCATION/AREA: Heroes Ave Taringa SP-N°-103

TEST SECTION DATA		TEST SECTION I.D.
LOCATION	WetWell/DryWell/ValvePit	ME 007
TEST MEDIUM	Water	
VOLUME	≈3000 Litres	
HIGH POINT	As Per Sketch	
LOW POINT	As Per Sketch	
GAUGE POINT	As Per Sketch	

PRESSURE RATING OF EQUIPMENT IN TEST SECTION

ITEM	TAG NO.	RATING M.A.O.P.KPa
Pump 1	182521	600 KPA
Pump 2	182523	600 KPA
Pump 3	182522	600 KPA

TEST EQUIPMENT DATA

DESCRIPTION	MAKE	SERIAL NO.	CALIBRATED BY	DATE
PRESSURE GAUGE	Wika	69911	A.C.S	29-7-05
PRESSURE RECORDED	-	-	-	-
AMB TEMP. RECORDER	-	-	-	-
AMB. THERMOMETER	-	-	-	-

PRESSURISING DATE

TIME	PRESSURE KPa	AMB. TEMP. °C
15:00	900	18°
15:25	875	18°

STRENGTH TEST DATA

TIME	PRESSURE KPa	AMB. TEMP. °C

LEAK TEST DATE

TIME	PRESSURE KPa	AMB. TEMP. °C

Supervisor report: See Attached Site Memo

STED BY: (NAME & SIGNATURE) Rene Boncers

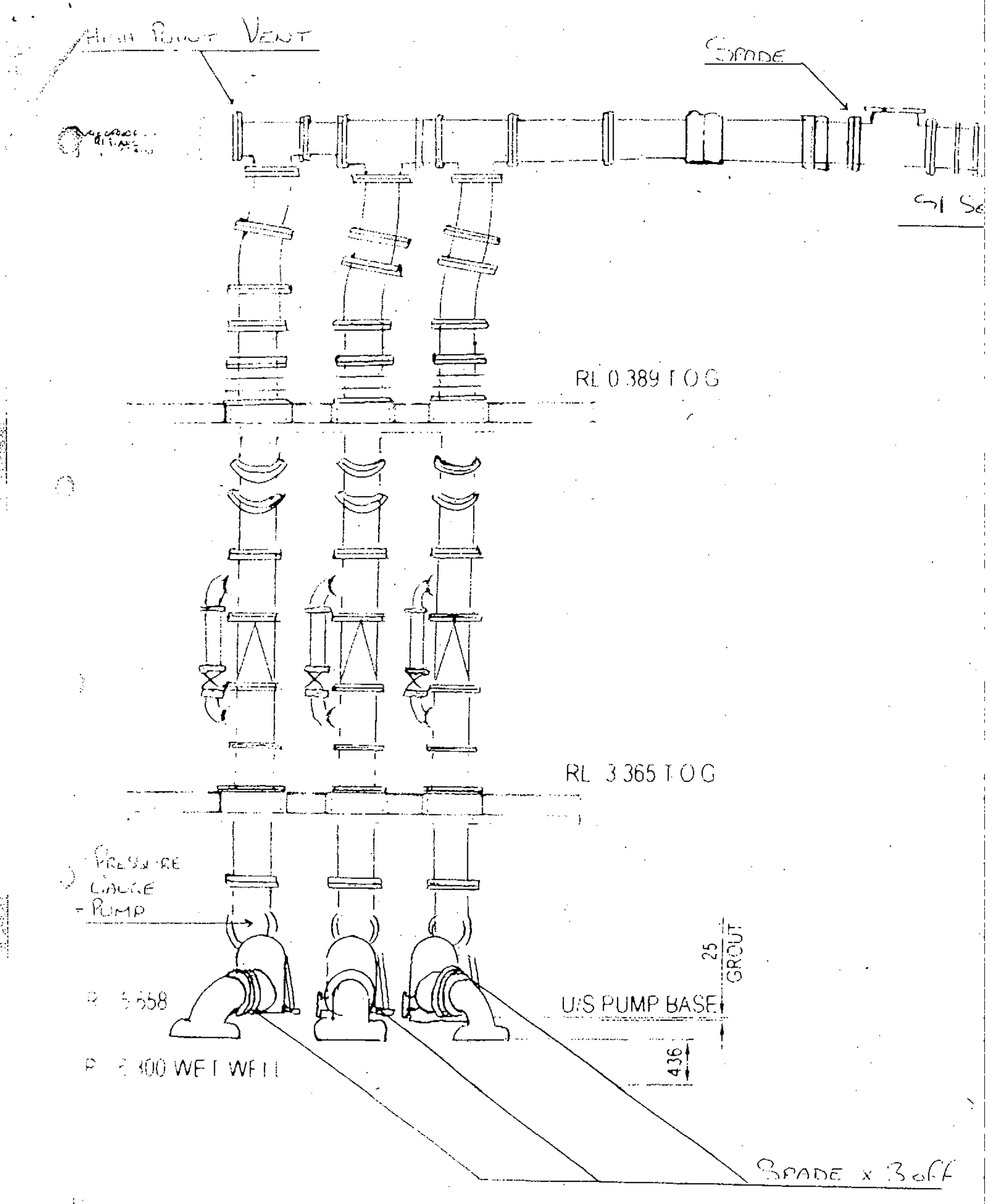
WITNESSED BY: (NAME & SIGNATURE) Reg McGinn

8/8/05

Page 1 of 1

Date of last revision 19/12/03

F:\3251Q Brisbane Water Heroes Avenue\11 Commissioning\F ORM 90F doc



Hydro Test # 1 (Detail)

hps HVAC

SITE MEMO SM

TO BRISBANE WATER

CONTRACT NAME HEROES AVE

HVA/HPS JOB No. 3251 Q

HYDROSTATIC TEST REPORT (ATTACHMENT)

DATE 4/8/05

As requested by Reg Mcgirr (Brisbane water) the following comments are to noted on the "HYDRO STATIC TEST REPORT".

(1) Test started at approx 1500Hrs on 4th day of August 2005. Duration of test approx 24 mins.

(2) Original test pressure 900Kpa. At the end of the 24 mins the pressure had dropped 25Kpa Bringing it down to 875Kpa.

(3) After a total of 47 pumps of the "Test Bucket" approx 3 Litres of water the original test pressure Was achieved.

(4) The water lost was the result of - Pumps 2 & 3 passing water at the "O" Ring seal of the water Jacket.

- Slight leak at the pressure indicator band.

(5) After inspecting the pipes associated in the - Dry Well

- Wet Well

- Valve Pit

No other leaks were detected.

☐ CONTRACT VARIATION ☐ DIRECTIVE REQUIRED ☐ BACKCHARGE ☐ MEMO ONLY

Signature of person issuing memo Rene' Bongers Date 4/08/05

Signature of person receiving memo . Date

White - Original; Blue - Job File; Yellow – Office

BVQI QA ISO 9001

AUSTRALIAN
CALIBRATING
SERVICES (A'SIA) PTY. LTD.
A.B.N. 33 623 153 736

126 Oxford Street, Collingwood
P.O. Box 1174, Collingwood, Vic. 3066, Australia
Phone: +61 3 9417 5688, Fax: +61 3 9417 1578

File No: Q.AC/635-E-1
Issue Date: 29 Jul 2005
Page: 1 of 1

SCN537V3.27

CALIBRATION REPORT
AN INDUSTRIAL PRESSURE GAUGE

FOR: HVAC CONSTRUCTIONS QLD PTY LTD
101 COBALT STREET
CAROLE PARK
QLD 4300

LOCATION: ACS Brisbane

TEST DATE: 28 July 2005

EQUIPMENT DETAILS:

Gauge Details
Maker: WIKA
Model: 1600x20kPa
Serial Number: 69911 Capacity: 1600 kPa
Plant Number: Nil Resolution: 20 kPa

TEST DETAILS:

Australian Standard AS1349:1986
"Bourdon Tube Pressure and Vacuum Gauges"
Section 4. Performance and Testing

- The pressure gauge was calibrated in a vertical position with increasing and decreasing pressure. The case of the pressure gauge was lightly tapped before each reading.
- The pressure medium was mineral oil.
- The Ambient Temperature during calibration was 20 °C
- Reference Equipment: Q.AC/1000-3F
- Uncertainty Confidence Level = 95%: Coverage Factor k = 2

COMMENTS: The gauge was found to be in a satisfactory condition.

PERFORMANCE TABLE:

Applied Pressure (kPa)	*As Found and Left (kPa)*	*Increasing (kPa) Reading*	*Increasing (kPa) Correction*	*Decreasing (kPa) Reading*	*Decreasing (kPa) Correction*	*Uncertainty (kPa)*
400	405	405	-5.0	405	-5.0	±3.3
800	805	805	-5.0	805	-5.0	±3.3
1200	1,200	1,200	0.0	1,200	0.0	±3.3
1600	1,595	1,595	+5.0	1,595	+5.0	±3.3

OVERLOAD TEST: The overload test was not performed.

CONCLUSION: The pressure gauge complied with the specification requirements

RECOMMENDED DATE OF NEXT CALIBRATION: 28 July 2006 (1 Year)

Signed A Tiedemann
A. TIEDEMANN
Approved Signatory
AUSTRALIAN CALIBRATING SERVICES (A'SIA) PTY LIMITED

NATA
NATA Accredited Laboratory Number 1239
The tests, calibrations or measurements covered by this document have been performed in accordance with NATA

SAT

F.2

4.2 Switchboard Pre-Commissioning SAT

4.2.1 Purpose

Pre-commissioning of the switchboard includes requirements detailed within the specification that includes all site testings of the switchboard prior to energisation. This ensures the switchboard is safe to apply power upon.

After energisation, tests shall be conducted on components, switches, breakers to ensure correct operation and voltages. This ensures all protective devices are checked and verified for correct operation, and the switchboard is safe for commissioning.

4.2.2 Scope

The testing will be carried out in accordance with Common Logic SAT which covers requirements detailed in the specification and includes:

- Electrical Earthing System
- Insulation Resistance Test
- General Wiring and Visual Inspection
- Continuity Test – point to point test all field wirings in accordance with cable schedule
- Component Operational Test – components testing after energisation to verify correct operation and voltages including I/Os

4.2.3 Procedures

Refer to Section 2 to 5 of Common Logic SAT which contain procedure and test sheets for all pre-commissioning tests prior to energising the switchboard.

Before energising, all components, switches, breakers should be suitably locked and tagged. The main supply is than applied and each component, switches and breakers shall be tested and have locks, tags removed after correct operation verification. Section 6 of Common Logic SAT covers this test.

< Common Logic SAT Attachment >

COMMON LOGIC Pty Ltd
Specialist Electrical Contractors

Site Acceptance Tests

Subject: Switchboard Pre-Commissioning SAT for Heroes Avenue Pump Station	Sheet: 1 Of: 14	Section 1

Page Revision No: 0 Date: 30/06/05 Manual Issue No: 0 Date: 30/06/05

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1.3 SAFETY PRECAUTIONS 2

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2.1 ELECTRICAL CONTINUITY AND RESISTANCE OF EARTHING SYSTEM 3
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3.1 INSULATION RESISTANCE TEST 5
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4.1 GENERAL WIRING AND VISUAL INSPECTION 6
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Test Carried out by...... Signed... Date...

Test witnessed by........ Signed... Date...

Authorised By:

COMMON LOGIC Pty Ltd **Specialist Electrical Contractors**	Site Acceptance Tests	
Subject: Switchboard Pre-Commissioning SAT for Heroes Avenue Pump Station	Sheet: 2 Of: 14	Section 1
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1.0 SITE ACCEPTANCE TESTS

1.1 Introduction

Complete EVERY box below; if items are not applicable indicate by a N/A in the check box, any comments can be completed at the end of the checklist.
Aim: This Commissioning list is to be completed by the person/s who are undertaking the commissioning and testing of the switchboard in question. The commissioning list is designed to check the fundamental wiring of the switchboard and all associated cabling and equipment.
Scope: This Commissioning list is designed to test the operation of the MSB and Controls.

Legend of Symbols

☐ Check Box, ⊗ Setting to be recorded, → and Action to take

1.2 Production Unit Information

Job Number		**Job Description**	
	Name	**Signature**	**Date**
Testing Officer	W. Wong	WWong	14/07/05
Witness			

1.3 Safety precautions

Outlined below are some common safety procedures and First Aid Instruction.

SAFETY FIRST

1) Never test live boards alone. Always inform others of your actions and intentions.
2) Isolate mains and locate and identify the main switch.
3) Isolate the switchboard main switch and all circuitbreakers and fuses to completely remove all possibility of switching a live conductor when not deliberately required.
4) Tag all Distribution as DO NOT OPERATE removing only after tested and safe.
5) Insure NO LIVE WIRES are exposed at any time and a CLEAR TESTING AREA and escape route at all times.
6) PROTECTIVE CLOTHING and eyewear should be worn at all times.
7) Insure there is a suitable fire extinguisher available at all times.
8) Insure that a suitable LV rescue kit is available and ready for use.

Test Carried out by......	Signed...	Date...
Test witnessed by........	Signed...	Date...
Authorised By:		

2.0 ELECTRICAL EARTHING SYSTEM

2.1 Electrical continuity and resistance of earthing system

☐ Maximum resistance of the Earthing system within the switchboard is 0.5 ohms (AS/NZS 3000:2000)

⊗ Test resistance of the Earthing system <0.5 ohms

2.2 Test keys

The following table describes the key to the numbered testing system

Key	Description
1	Main switch compartment
2	Metering CTs compartment
3	ATS compartment
4	Cable zone compartment
5	Distribution board compartment
6	Harmonic filter compartment
7	Power meter / Surge protection compartment
8	Pump 3 compartment
9	Pump 2 compartment
10	Pump 1 compartment
11	PLC and RTU compartment
12	Pump 1
13	Pump 2
14	Pump 3
15	Sump pump
16	Vent fan
17	General lightings and power
18	Level Transmitter
19	Pressure Transmitter
20	Flowmeter
21	Odour Control
22	Cathodic protection

Test Carried out by...... Signed... Date...

Test witnessed by........ Signed... Date...

Authorised By:

COMMON LOGIC Pty Ltd **Specialist Electrical Contractors**	Site Acceptance Tests	
Subject: Switchboard Pre-Commissioning SAT for Heroes Avenue Pump Station	Sheet: 4 Of: 14	Section 2
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2.3 Continuity Test Sheet

ITEM	DETAIL	COMPARTMENT DESIGNATION AND TEST RESULT										
		1	2	3	4	5	6	7	8	9	10	11
1	All Earth's wired and continuous	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	All metal work earthed where required	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	Isolate Individual Earth Systems and check continuity.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4	Test resistance of Earthing system to compartment Answer in Ohms	<0.5Ω →										
ITEM	DETAIL	GENERAL AREAS TEST RESULT										
		12	13	14	15	16	17	18	19	20	21	22
1	All Earth's wired and continuous	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	All metal work earthed where required	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	Isolate Individual Earth Systems and check continuity.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4	Test resistance of Earthing system to device Answer in Ohms	<0.5Ω →										

Test Carried out by....William Wong
Rand Burke Signed..William Wong Date..13/07/05

Test witnessed by........ Signed... Date...

Authorised By:

COMMON LOGIC Pty Ltd
Specialist Electrical Contractors

Site Acceptance Tests

Subject: Switchboard Pre-Commissioning SAT for Heroes Avenue Pump Station	Sheet: 5 Of: 14	Section 3

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3.0 INSULATION RESISTANCE/ HIGH POT TEST

3.1 Insulation Resistance Test

Insulation resistance of whole or part of an installation must be a minimum of 1 Meg/ohm (AS/NZS 3000:2000)

- ☐ Insulation test conducted on all internal circuits
- ☐ Insulation test conducted on all busbar
- ☐ Insulation test conducted on all motors
- ☐ Insulation test conducted on L&P circuits

→ All Selector Switches, Isolators and CB's are in the off position
→ Surge Diverter Disconnected
→ Remove MEN LINK before insulation test
→ All electronic equipment susceptible to high voltage damage to be isolated.

3.2 Low Voltage Switchboards Insulation Test

MEGGAR VOLTAGE 500 VOLTS
INSTRUMENT DETAILS SK-3005

Switchboard and mains.

ACROSS	RESULT (M.OHM)	High Pot Sump Pump	Motor 1 (1000V)	Motor 2 (1000V)	Motor 3 (1000V)
Join Red, White & Blue Phases and Neutral, Test to Earth	200				
Red Phase to White, Blue & N	200		900MΩ	900MΩ	1000MΩ
White Phase to Red, Blue and N	200		900MΩ	1000MΩ	900MΩ
Blue Phase to Red, White & N	200		900MΩ	1000MΩ	800MΩ
N to Red, White & Blue	200				

Test Carried out by...... Rand Barke Signed... [signature] Date... 23/06/05

Test witnessed by........ William Wong Signed... [signature] Date... 14/07/05

Authorised By:

COMMON LOGIC Pty Ltd
Specialist Electrical Contractors

Site Acceptance Tests

Subject: Switchboard Pre-Commissioning SAT for Heroes Avenue Pump Station	Sheet: 6 Of: 14	Section 4

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4.0 GENERAL WIRING AND VISUAL INSPECTION

4.1 General Wiring and Visual Inspection

- ☐ Electrical Construction Coversheet DWG No. 486/5/7-U010 Completed and correct.
- ☐ Check all cables as per schedules have been installed.
- ☐ Check all devices have been terminated

4.2 Switchgear Visual Checklist

→ Carry out visual and mechanical checks to Switchgear

ITEM NO:	DETAIL	DESIGNATION							
		1	3	8	9	10	15	16	17
1	Main Switch totally isolates SWBD	✓	✓	✓	✓	✓	✓	✓	
2	Cables tight and correct phase rotation.	✓	✓	✓	✓	✓	✓	✓	
3	MEN connected and Neutral tight.	✓							
4	Main Switch fuse in place marked correctly	✓							
5	ATS is operational	✓							
6	Surge diverter in place, earth neutral wired correctly	✓							

ITEM NO:	DETAIL	REAR COMPARTMENT DESIGNATION							
1	All cables connected as per schedules.	✓							
2	Motor Junction boxes connected and correct .	✓							
3	Check all motor cables are connected as per supplier instructions	✓							
4									
5									

Test Carried out by..W. Wong Signed.......... Date..13/07/05

Test witnessed by........ Signed... Date...

Authorised By:

COMMON LOGIC Pty Ltd **Specialist Electrical Contractors**	Site Acceptance Tests	
Subject: Switchboard Pre-Commissioning SAT for Heroes Avenue Pump Station	Sheet: 7 Of: 14	Section 4
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4.3 Terminal Visual Checklist

→ Carry out visual and mechanical checks on Site terminals

ITEM	DETAIL	SWITCHBOARD AND JUNCTION BOXES										
		3	5	7	8	9	10	11	12	13	14	
1	All Terminals tight (Randomly check)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
2	All Voltage types separated by segregation plate (Check All)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
3	Correct current ratings for cable as per DWG. (Check all)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
4	Secure by End Clamps (Check All)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
5	Labelled correctly as per drawings and contract specification	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
6	Easily accessible.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
7	Field connection Terminals are correct type as per contract specification	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
8	High Voltage Terminal Shrouded	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	

Test Carried out by.... W. Wong Signed. William Wong Date.. 14/07/05

Test witnessed by........ Signed... Date...

Authorised By:

COMMON LOGIC Pty Ltd **Specialist Electrical Contractors**		Site Acceptance Tests
Subject: Switchboard Pre-Commissioning SAT for Heroes Avenue Pump Station	Sheet: 8 Of: 14	Section 5
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5.0 CONTINUITY TEST

5.1 Continuity Test

- ☐ Wiring of field circuits and connections are correct to constructed wiring schematics and marked up cable schedule – BW DWG No. 486/5/7-LIO30
- ☐ Random Continuity Test using Buzzer.
- ☐ Visual Check of all wiring.

→ Open all Circuit breakers and remove all fuse links
→ Test each cabling in turn with cable schedule
→ Continue to carry out visual and drawing checks (ie wire numbers, etc)
→ Bridge control points to check operation if possible.
→ Mark each circuit as it is tested using a highlight pen.
→ Tick of each compartment associated with the specified drawing.
→ Test may be carried out with the RTU DC system on line and utilising the control device to create the feedback.
→ Point to point the cabling from the terminals to the generator plug. Communications device will be required to achieve this.

ITEM NO:	Cable No.	COMPARTMENT DESIGNATION												
		1	2	3	4	5	6	7	8	9	10	11		
1	P02			✓										
2	P03A										✓			
3	P04A									✓				
4	P05A								✓					
5	P03B													
6	P04B N/A													
7	P05B													
8	P06							✓						
9	P07					✓								
10	P08					✓								
11	P09					✓								
12	P10					✓								
13	P11 N/A													
14	P12 N/A	Generator not connected												
15	P13					✓								
16	P14					✓								
17	P15						✓							
18	P16					✓						✓		

Test Carried out by..W. Wong	Signed. [signature]	Date..14/07/05
Test witnessed by……..	Signed…	Date…
Authorised By:		

COMMON LOGIC Pty Ltd
Specialist Electrical Contractors

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ITEM NO:	Cable No.	COMPARTMENT DESIGNATION												
		1	2	3	4	5	6	7	8	9	10	11		
19	C01													
20	C02											✓		
21	C03											✓		
22	C04											✓		
23	C05											✓		
24	C06											✓		
25	C07A										✓			
26	C07B										✓			
27	C08A									✓				
28	C08B									✓				
29	C09A								✓					
30	C09B								✓					
31	C10A													
32	C10B													
33	C11A													
34	C11B	N/A												
35	C12A													
36	C12B													
37	I01	→ No Cathodic Protection Control Signals												
38	I02A											✓		
39	I02B	N/A - Flowmeter Sensor to be calibrated												
40	I03											✓		
41	I04							✓						
42	I05A											✓		
43	I05B	N/A - Pressure Tx Sensor to be calibrated												
44	I06	N/A - Vega Level Tx Sensor to be calibrated												
45	I07							✓						
46	I08											✓		
47	I09	N/A - Generator Modbus link												
48	I10											✓		
49	I11											✓		
50	I12											✓		
51														
52														
53														
54														
55														

Test Carried out by…W. Wong Signed. [signature] Date..14/07/05

Test witnessed by…….. Signed… Date…

Authorised By:

COMMON LOGIC Pty Ltd
Specialist Electrical Contractors

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5.2 POWER CABLE AND BAR Test

- ☐ Checking of all bus bar joints for connection.
- ☐ Visual Check of Bus bars.

→ Connect the test unit across each joint in the bus bar and cable power connection system.
→ Tick off the relevant area associated with the AC drawings when tested.
→ Highlight the AC drawings to detail each connection that has been tested.

ITEM NO:	Drawing Number/ Section	COMPARTMENT DESIGNATION								
		1	3	5	6	7	8	9	10	
1	486/5/7-LIO10	✓	✓	✓	✓					
2	486/5/7-LIO11						✓			
3	486/5/7-LIO12							✓		
4	486/5/7-LIO13								✓	
5	486/5/7-LIO14					✓				
6	486/5/7-LIO15									
7	486/5/7-LIO16									
8	486/5/7-LIO17									
9	486/5/7-LIO18									
10	486/5/7-LIO19									
11	486/5/7-LIO20									
12	486/5/7-LIO21									
13	486/5/7-LIO22	N/A - Control Circuits								
14	486/5/7-LIO23									
15	486/5/7-LIO24									
16	486/5/7-LIO25									
17	486/5/7-LIO26									
18	486/5/7-LIO27									
19	486/5/7-LIO28									
20	486/5/7-LIO29									

Test Carried out by... W. Wong Signed.. [signature] Date.. 14/07/05

Test witnessed by,....... Signed... Date...

Authorised By:

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6.0 COMPONENT OPERATIONAL TEST

6.1 Component Operation Test

- ☐ Correct Operation and Voltages
- ☐ All set points and parameters set to test values if required.
- ☐ All switches and buttons operate as required.
- ☐ All RTU IO are connected and operate as designed.
- ☐ All external devices operate as designed.

6.2 AC Control Systems

→ Open all circuit breakers and remove all fuse links

→ Test each cubicle individually, replacing fuses and closing circuit breakers in turn.

<u>AFTER VOLTAGE APPLIED</u>

→ Apply mains supply

→ Carry out voltage and operational checks (ie switch operation etc)

→ Bridge control points to check operation

ITEM NO:	DETAIL	COMPARTMENT DESIGNATION							
		1	3	7	bus	5	11		
1	Mains Incoming Voltage Measured OK	✓							
2	All CB's are turned off and isolate Crts	✓	✓	✓		✓	✓		
3	Phase Fail operates correctly	✓		✓					
4	Phase Fail Hysteresis time setting _sec	10s							
5	Turn on main switch	✓							
6	Phase fail relay operates correctly	✓		✓					
7	Supply available on ATS	✓							
8	Check power to Surge diverters	✓							
9	Install surge diverter fuses and test alarm to RTU	✓							
10	Check power to top of distribution MS					✓			
11	Turn on Distribution MS and check volts to bus bars					✓			
12	Check that there is a CB feeding the RTU and surge diverter relay. If Yes Turn on power to control surge filter	✓							
13	Test second phase fail relay is operating			✓					
14	Turn on the Power Meter and check settings.	✓							

Test carried out by.... W Wbray Signed..[illegible] Date..15/07/05

Test witnessed by........ Signed... Date...

Authorised By:

COMMON LOGIC Pty Ltd
Specialist Electrical Contractors

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6.3 DC control Systems

→ Carry out operational and voltage checks
→ Power up the RTU power supplies
→ Install DC supply fuses one at a time and check
→ Functional Testing includes pressing buttons, operating switches, simulating if actual operation is not possible.
→ Testing of external devices includes where possible the actual operation of the device by creating the real condition at the device.

ITEM NO:	DETAIL	COMPARTMENT DESIGNATION							
		8	9	10	11	7			
1	Check supply Voltage to Supply Transformer/Battery Charger				✓				
2	All DC Fuses in place and correct size				✓				
3	Power up the PLC. Drawing No. 486/5/7-LIO16				✓				
4	Power up the RTU. Drawing No. 486/5/7-LIO16				✓				
5	Insert Fuses and check associated IO points. Drawing No. 486/5/7-LIO17				✓				
6	Insert Fuses and check associated IO points. Drawing No. 486/5/7-LIO18				✓	tested @ FAT			
7	Insert Fuses and check associated IO points. Drawing No. 486/5/7-LIO19				✓	tested @ FAT			
8	Insert Fuses and check associated IO points. Drawing No. 486/5/7-LIO20				✓				
9	Insert Fuses and check associated IO points. Drawing No. 486/5/7-LIO21				✓	✓			
10	Insert Fuses and check associated IO points. Drawing No. 486/5/7-LIO22				✓				
11	Insert Fuses and check associated IO points. Drawing No. 486/5/7-LIO23				✓				
12	Insert Fuses and check associated IO points. Drawing No. 486/5/7-LIO24				✓				
13	Insert Fuses and check associated IO points. Drawing No. 486/5/7-LIO25				✓	tested @ FAT			
14	Insert Fuses and check associated IO points. Drawing No. 486/5/7-LIO26	← NA — Instruments calibration →							
15	Insert Fuses and check associated IO points. Drawing No. 486/5/7-LIO27				✓	tested @ FAT			
16	Insert Fuses and check associated IO points. Drawing No. 486/5/7-LIO28				✓	tested @ FAT			
17	Using a test loop test the control plug and lead to the generator	} TO BE TESTED IN COMMISSIONING							
18	Using a test loop test the control plug and lead to the generator. Drawing No. 486/5/7-LIO15								

Test Carried out by... W. Ubing Signed. [signature] Date... 20/07/05

Test witnessed by........ Signed... Date...

Authorised By:

COMMON LOGIC Pty Ltd
Specialist Electrical Contractors

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6.4 Motor protection and Operation

→ Carry out voltage, settings and Operational Checks

ITEM NO	DETAIL	COMPARTMENT DESIGNATION									
		8	9	10	11						
1	Confirm the motor VFD can be powered up. May need to remove the motor connections or put in hand stop mode.	✓	✓	✓							
2	Confirm operation of Motor CB and contactors and E/Stop incl. field E/stops	✓	✓	✓							
3	Confirm operation of Auxiliary Contacts back to the ~~RTU~~ PLC	✓	✓	✓							
4	Turn on the CB to the drive.	✓	✓	✓							
5	Confirm the VFD has the correct program installed.	✓	✓	✓							
6	Confirm operation of Contacts (manual start, auto start)	✓	✓	✓							
7	Confirm auto and manual commands										
8	Manually operate the drive with no motor connected.										
9	Automatically operate the VFD with no motor connected.										
10	Simulate the thermistor signal and test.										
11	Simulate the Water in oil signal and test.										
12	Simulate alarms and test the re-set facility		TO BE TESTED IN COMMISSIONING								
13	If there is water available the motor could be connected and run. Check Rotation										
14	Check manual operation again										
15	Check automatic operation again.										

Test Carried out by… M. Wang Signed… [signature] Date. 25/07/05

Test witnessed by…….. Signed… Date…

Authorised By:

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6.5 Miscellaneous Operational Tests

→ Carry out Voltage and Operational Checks of Miscellaneous Circuits

ITEM NO	DETAIL	ITEMS TESTED	COMPARTMENT DESIGNATION
1	Un plug the controls to the generator and temp board.		✓ 11/08/05
2	Plug in the generator control plug and test every IO point.		✓ 11/08/05
3	Simulate a mains fail and see if the generator wants to start. No real need to start.		✓ 11/08/05
4	Remove the generator power leads to the temp board and plug in the new connections.		✓ 11/08/05
5	Run generator and test rotation.		✓ 11/08/05
6	Insure rotation across the ATS is correct.		✓ 11/08/05
7	Manually connect the generator and test run 1 pump if water is available.		✓ 11/08/05
8	Put all to auto and simulate a generator start and transfer and return to mains.		✓ 11/08/05
9			
10	Commissioning of Level device	Vegawell 72	✓
11	Reflux valves microswitches	✓	
12	Well Washer	Solenoid valve ✓	✓
13	Commissioning of pressure device	Vegabar 64	✓
14	Cathodic Protection Unit	✓	
15	Odour Control Unit	✓	
16	Light and power - RCD tested	✓	
17	Sump Pump Auto Start/Stop	✓	
18	Sump Pump Hand Start/Stop	✓	
19	Dry Well Flooded High Level Alarm	✓	
20	Dry Well Flooded Hi Hi Level Probe	✓	

Test Carried out by.... W. Wong Signed. [signature] Date... 15/07/05

Test witnessed by........ Signed... Date...

Authorised By:

4.3

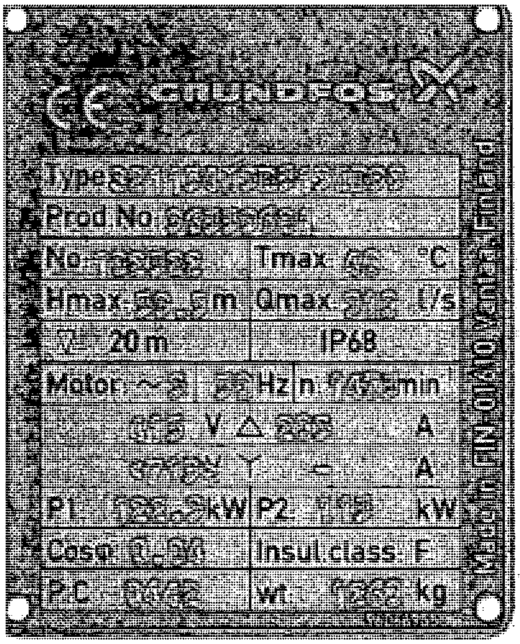
4.3 Variable Speed Drives Programming

4.3.1 Purpose

The purpose of programming the VSDs is provide the correct pump data to the drives, and the right settings to ensure valid communication to/from the control system

4.3.2 Scope

HVAC and Danfoss have already programmed the VSDs during factory acceptance testing. The motor parameters will require to be re-programmed with the information specified on the Grundfos pump nameplates:



Important parameters to verify for both setup 1 (local) and setup 2 (remote) include:

- Parameters to enable or disable keypads
- Minimum frequency
- Alarms reaction – warning or trip lock
- Digital and analogue I/O to interface with control system
- Current limit motor protection
- No PID settings – PID is PLC driven

4.3.3 Procedures

1. HVAC to program and verify parameters of the VSDs with assistance from Danfoss.
2. Scroll through each parameter in VSD1 and check for correct setting for both local and remote mode (setup 1 and 2). To change the setup mode, flick the LOCAL/REMOTE switch.
3. Along the way, record all parameter settings on the VSD Programming Parameter Record Sheet. Highlight any settings unsure of, and notify or ask Brisbane Water.
4. After all parameters have been verified in VSD1, transfer all parameter settings across to the other two drives by utilising the LCD COPY parameter 004 function.
5. Submit record to Brisbane Water for verification.

< VSD Programming Parameter Record Attachment >

Programmed by: Nick Taylor - Danfoss
Date: 19/07/2005
Latest Revision: 11/08/2005 - William Wong

ID	Name	Setup 1 (Remote)	Setup 2 (Local)	Unit
1	Language	English (0)	English (0)	
2	Active setup	Multi setup (5)	Multi setup (5)	
3	Setup copy	No copy (0)	No copy (0)	
4	Lcp copy	No copy (0)	No copy (0)	
5	Custom readout	100	100	
6	Cust. read. unit	-1%	-1%	
7	Large readout	Frequency [Hz] (3)	Frequency [Hz] (3)	
8	Small readout 1	Reference [%] (1)	Reference [%] (1)	
9	Small readout 2	Motor current [A] (5)	Motor current [A] (5)	
10	Small readout 3	Power [kW] (6)	Power [kW] (6)	
11	Unit of loc ref	Hz (0)	Hz (0)	
12	Hand start bttn	Enable (1)	Enable (1)	
13	Stop button	Enable (1)	Enable (1)	
14	Auto start bttn	Enable (1)	Enable (1)	
15	Reset button	Enable (1)	Enable (1)	
16	Data change lock	Not locked (0)	Not locked (0)	
17	Power up action	Auto restart (0)	Auto restart (0)	
100	Config. mode	Open loop (0)	Open loop (0)	
101	Vt charact.	Aeo function (0)	Aeo function (0)	
102	Motor power	122.3	122.3	kW
103	Motor voltage	415	415	V
104	Motor frequency	50	50	Hz
105	Motor current	203	203	A
106	Motor nom. speed	1475	1475	RPM
107	Auto motor adapt	No ama (0)	No ama (0)	
108	Multim.startvolt	2.5	2.5	V
109	Resonance damp.	100	100	%
110	High start torq.	0	0	s
111	Start delay	0	0	s
112	Motor preheat	Disable (0)	Disable (0)	
113	Preheat dc curr.	50	50	%
114	Dc brake current	50	50	%
115	Dc braking time	10	10	s
116	Dc brake cut-in	0	0	Hz
117	Mot.therm protec	Thermistor trip (2)	Thermistor trip (2)	
118	Motor pwr fact	0.75	0.75	
200	Frequency range	0-120 hz (0)	0-120 hz (0)	
201	Min. frequency	28	28	Hz
202	Max. frequency	50	50	Hz
203	Reference site	Linked to hand/auto (0)	Linked to hand/auto (0)	
204	Min. reference	0	0	
205	Max. reference	50	50	
206	Ramp up time	20	20	s
207	Ramp down time	40	40	s
208	Autoramping	Enable (1)	Enable (1)	
209	Jog frequency	35	35	Hz
210	Ref. function	External/preset (2)	External/preset (2)	

ID	Name	Setup 1	Setup 2	Unit
404	Sleep frequency	0	0	Hz
405	Wakeup frequency	30	30	Hz
406	Boost setpoint	100	100	%
407	Switch freq.	3	3	kHz
408	Noise reduction	Asfm (0)	Asfm (0)	
409	Funct. low curr.	Warning (1)	Warning (1)	
410	Mains imbalance	Autoderate & warning (1)	Autoderate & warning (1)	
411	Funct. overtemp.	Autoderate & warning (1)	Autoderate & warning (1)	
412	Overload delay	61	61	s
413	Min. feedback	0	0	
414	Max. feedback	100	100	
415	Ref./fdbk. unit	-1%	-1%	
416	Feedback conv.	Linear (0)	Linear (0)	
417	2 feedback calc.	Maximum (1)	Maximum (1)	
418	Setpoint 1	0	0	
419	Setpoint 2	0	0	
420	Pid nor/inv.ctrl	Normal (0)	Normal (0)	
421	Pid anti windup	Enable (1)	Enable (1)	
422	Pid start value	35	35	Hz
423	Pid prop. gain	0.3	0.3	
424	Pid integr. time	9,999.00	9,999.00	s
425	Pid diff. time	0	0	s
426	Pid diff. gain	5	5	
427	Pid filter time	0.01	0.01	s
500	Protocol	Fc (0)	Fc (0)	
501	Address	1	1	
502	Baud rate	9600 baud (5)	9600 baud (5)	
503	Coasting	Logic or (3)	Logic or (3)	
504	Dc brake	Logic or (3)	Logic or (3)	
505	Start	Logic or (3)	Logic or (3)	
506	Reversing	Digital input (0)	Digital input (0)	
507	Select. setup	Logic or (3)	Logic or (3)	
508	Select. speed	Logic or (3)	Logic or (3)	
533	Displ.text line1			
534	Displ.text line2			
555	Bus time inter.	60	60	s
556	Bus time funct.	No function (0)	No function (0)	
560	N2 over.rel.time	65534	65534	s
565	Fln time inter.	60	60	s
566	Fln time funct.	No function (0)	No function (0)	
570	M.bus par./frame	No parity/ 1 stopbit (2)	No parity/ 1 stopbit (2)	
571	M.bus com.time.	100	100	ms
618	Reset kwh count	Do not reset (0)	Do not reset (0)	
619	Reset run. hour	Do not reset (0)	Do not reset (0)	
620	Operation mode	Normal operation (0)	Normal operation (0)	

ID	Name	Setup 1	Setup 2	Unit
211	Preset ref. 1	100	100	%
212	Preset ref. 2	0	0	%
213	Preset ref. 3	0	0	%
214	Preset ref. 4	0	0	%
215	Curr limit motor	203	203	A
216	Freq bypass b.w.	0	0	Hz
217	Bypass freq. 1	120	120	Hz
218	Bypass freq. 2	120	120	Hz
219	Bypass freq. 3	120	120	Hz
220	Bypass freq. 4	120	120	Hz
221	Warn. current lo	0	0	A
222	Warn. current hi	203	203	A
223	Warn. freq. low	0	0	Hz
224	Warn. freq. high	120	120	Hz
225	Warn. low ref.	-1,000,000.00	-1,000,000.00	
226	Warn. high ref.	1,000,000.00	1,000,000.00	
227	Warn. low fdbk	-1,000,000.00	-1,000,000.00	
228	Warn. high fdbk	1,000,000.00	1,000,000.00	
300	Digital input 16	Reset (1)	Reset (1)	
301	Digital input 17	No operation (0)	No operation (0)	
302	Digital input 18	Start (1)	Start (1)	
303	Digital input 19	No operation (0)	No operation (0)	
304	Digital input 27	Safety interlock (3)	Safety interlock (3)	
305	Digital input 29	Preset ref. on (6)	No operation (0)	
306	Digital input 32	Setup select lsb (4)	Setup select lsb (4)	
307	Digital input 33	No operation (0)	No operation (0)	
308	Ai [V] 53 funct.	No operation (0)	Reference (1)	
309	Ai 53 scale low	0	0	V
310	Ai 53 scale high	10	10	V
311	Ai [V] 54 funct.	Thermistor input (3)	Thermistor input (3)	
312	Ai 54 scale low	0	0	V
313	Ai 54 scale high	10	10	V
314	Ai [mA] 60 funct	Reference (1)	No operation (0)	
315	Ai 60 scale low	4	4	mA
316	Ai 60 scale high	20	20	mA
317	Live zero time	10	10	s
318	Live zero funct.	Stop and trip (5)	No function (0)	
319	Ao 42 function	Out. freq. 4- 20 ma (30)	Out. freq. 4- 20 ma (30)	
320	Ao 42 puls scale	5000	5000	Hz
321	Ao 45 function	Drive in auto mode (17)	Drive in auto mode (17)	
322	Ao 45 puls scale	5000	5000	Hz
323	Relay 1 function	Ready (1)	Ready (1)	
324	Relay1 on delay	0	0	s
325	Relay1 off delay	0	0	s
326	Relay 2 function	Running (3)	Running (3)	
327	Pulse ref. max	5000	5000	Hz
328	Pulse fdbk. max.	25000	25000	Hz
400	Reset function	Manual reset (0)	Manual reset (0)	
401	Autorestart time	10	10	s
402	Flying start	Disable (0)	Disable (0)	
403	Sleep mode timer	301	301	s

4.4 Pumps Pre-Commissioning Testing

4.4.1 Purpose

The purpose of this testing is to ensure the installation of the pumps are mechanically and electrically sound, and the pumps are ready for commissioning.

4.4.2 Scope

The testing involves a general check of the pump for transport/installation damages, secure installation, and correct motor rotation and operation.

4.4.3 Procedures

Procedures and checklist for conducting the testing are detailed in the test sheet. Each of the 3 pumps shall be tested with the associated test sheets completed and signed.

When performing motor directional test, the associated VSD shall be hand started briefly to determine motor rotation direction. Changes to phasing to obtain correct motor rotation shall be corrected on the motor feeder cables only. (ie. load side of pump disconnect box).

Other observations to performed when a pump is started is to check for any unusual noise or vibration, correct voltage and current drawn – displayed on respective VSD LCD screen.

< *Pump Pre-Commissioning Test Sheets Attachment* >

HVAC hps

PRE-COMMISSIONING TEST
PUMP

PROJECT:	Heroes Avenue Sewage Pump Station	PROJECT NO.	3251Q
TYPE NO.	S21154M3B513ZB93	SERIAL NO.	182521
LOCATION:	Heroes Avenue, Taringa	PROD. NO.	96553681
UNIT TYPE	Grundfos 115kW	DATE	8/8/05

ACTION REQUIRED		CHECKED Initial
Check unit for transport/installation damage		RB
Remove debris/clean unit inside and out		RB
Inspect general condition and operation of equipment		W.W.
Check vibration mountings and tightness of fixing bolts		RB
Check operation of valves in pipework		RB
Check pump and motor bearings and/or glands (lubricate if necessary)		NA
Check tightness of pulleys on shafts		NA
Check tension and alignment of drive belts and pulleys		NA
Tighten belt guards		NA
Check completeness of electrical work (wiring, contractor, overloads, controls etc)		W.W.
Open all valves prior to starting pump		RB
Ensure pump start will not create unsafe conditions		W.W.
Start Pump - to check direction of rotation only		W.W.
Check for any unusual noise or vibration		W.W.
Check alignment and water tightness of all connections		RB
Check voltage	415V	W.W.
Check and record pump motor amps and stop pump	185A@50Hz→3154s	W.W.

COMMENTS: Pump No 1

HVAC/HPS TECHNICAL SUPERVISOR: [signature] 08/08/2005

HVAC hps

PRE-COMMISSIONING TEST

PUMP

PROJECT:	Heroes Avenue Sewage Pump Station	PROJECT NO.	3251Q
TYPE NO.	S21154M3B513ZB93	SERIAL NO.	182523
LOCATION:	Heroes Avenue, Taringa	PROD. NO.	96553681
UNIT TYPE	Grundfos 115kW	DATE	8/8/05

ACTION REQUIRED		**CHECKED** Initial
Check unit for transport/installation damage		RB
Remove debris/clean unit inside and out		RB
Inspect general condition and operation of equipment		W.W.
Check vibration mountings and tightness of fixing bolts		RB
Check operation of valves in pipework		RB
Check pump and motor bearings and/or glands (lubricate if necessary)		N/A
Check tightness of pulleys on shafts		N/A
Check tension and alignment of drive belts and pulleys		N/A
Tighten belt guards		N/A
Check completeness of electrical work (wiring, contractor, overloads, controls etc)		W.W.
Open all valves prior to starting pump		RB
Ensure pump start will not create unsafe conditions		W.W.
Start Pump - to check direction of rotation only		W.W.
Check for any unusual noise or vibration		W.W.
Check alignment and water tightness of all connections		RB
Check voltage	415V	W.W.
Check and record pump motor amps and stop pump	182A@50Hz & 315L/s	W.W.

COMMENTS: Pump No 2

HVAC/HPS TECHNICAL SUPERVISOR: [signature] 08/08/05

HVAC hps

PRE-COMMISSIONING TEST
PUMP

PROJECT:	Heroes Avenue Sewage Pump Station	PROJECT NO.	3251Q
TYPE NO.	S21154M3B513ZB93	SERIAL NO.	182522
LOCATION:	Heroes Avenue, Taringa	PROD. NO.	96553681
UNIT TYPE	Grundfos 115kW	DATE	8/8/05

ACTION REQUIRED		CHECKED Initial
Check unit for transport/installation damage		RB
Remove debris/clean unit inside and out		RB
Inspect general condition and operation of equipment		W.W.
Check vibration mountings and tightness of fixing bolts		RB
Check operation of valves in pipework		RB
Check pump and motor bearings and/or glands (lubricate if necessary)		N/A
Check tightness of pulleys on shafts		N/A
Check tension and alignment of drive belts and pulleys		N/A
Tighten belt guards		N/A
Check completeness of electrical work (wiring, contractor, overloads, controls etc)		W.W.
Open all valves prior to starting pump		RB
Ensure pump start will not create unsafe conditions		W.W.
Start Pump - to check direction of rotation only		W.W.
Check for any unusual noise or vibration		W.W.
Check alignment and water tightness of all connections		RB
Check voltage	415V	W.W.
Check and record pump motor amps and stop pump	186A@50Hz ← 315L/s	W.W.

COMMENTS: Pump No 3

HVAC/HPS TECHNICAL SUPERVISOR: Willoughby 08/08/05

Page 1 of 1 Date of last revision: 19/12/2003 E:\3251Q Brisbane Water Heroes Avenue\T1 Commissioning\Heroes Ave Pumps.doc

ITR 01I	INSPECTION AND TEST RECORD INSTRUMENT CALIBRATION

HVAC

CONTRACT No	BW.30079-02/03	INSTRUMENT TYPE	Vegabar64 Pressure Transmitter (-1 to 10 bar range)
JOB No	3251Q	INSTRUMENT Serial No	14447963
Location	Heroes Avenue	LOCATION DRAWING No	486/5/7-LI007

TESTING EQUIPMENT DATA				
EQUIPMENT TYPE	MAKE	SERIAL NUMBER	CALIBRATED BY	DATE
Pressure Gauge	Fluke	8428005	VMS International	17/05/05
Pressure Transducer	(Fluke) (PV350)	X5-863 KIT16E	BCC Oxley Ck	

Taken on 08/08/05 10am

Induced Pressure (kPa)	Instrument Output (kPa)	
From calibrated gauge	As Found	
900		985
600		645
300	330	324
0	2.5	9.7

Induced (kPa)	Instrument (kPa)
900	903
584	586
296	296
500	512
2.0	2.3

Pressure Recordings taken on 09/08/05 10:45am

6360

Comments: Measure well level at ~~6360~~ relative to Orange cross on 09/08/05 @ 11:55am

PRINT NAME	SIGNATURE	DATE
INSPECTED BY	W. WONG [signature]	09/08/05
WITNESSED BY		

Reg McGirr [signature] 09/08/05

Flowmeter Calibration Verification Certificate

Customer	Brisbane Water
Date Performed	Thursday 21 July 2005 09:33
Date Certificate Printed	Monday 25 July 2005 08:40

Site Details

Location	SP 103
Tag	5428814
Operator	John Grant

Results :

Transmitter Zero	Pass
Transmitter Span	Pass
Transmitter Pulse Output	Not Tested
Transmitter Analogue Output	Pass
Sensor Electrode Integrity	Pass
Sensor Energising Coil Integrity	Pass

Declared "FULL" pipe status appears to be FULL.

Accuracy :

The above tests and results verify that the flowmeter is functioning within normal working limits, and is within ±2% of original calibration certificate.

Transmitter Settings

Sensor Calibration Factor	1.4035/2/5/1.000
Flow Range	500.0 l/s
Response Time Constant	3 seconds
Probe Factors	ins 1.00000, prof 1.00000
Analogue Output	4-20 Forward
Second Analogue Range	100.0% (500.0 l/s)
Pulse Output	Not Tested
Totaliser Units	Kilo l

Calmaster Details

Instrument, Serial No.	CM0139, V/38364/1/1
Last Calibrated	Tue 14 Dec 2004
Next Calibration Date	Wed 14 Dec 2005
Firmware Version	CalMaster v1.0 36/96
PC Software Version	v2.31 25/08/2004 (Intn.)
DVM Serial No.	
Resistor Serial No.	(Not Used)

Flowmeter Details

Type	MagMaster, Electromagnetic
Sensor S/No.	P/26949/3/5
Transmitter S/No.	vkh06125
Tag No.	5428814
Meter Size	350 mm

CalMaster is fully traceable to National and International Standards.
For details please refer to CalMaster Traceability Documentation.

ABB World Flow Technology Centres

ABB Limited., Oldends Lane, Stonehouse Gloucestershire England, GL10 3TA Tel +44 (0) 1453 82 6661 Fax +44 (0) 1453 82 1478	ABB Inc, 125 E County Line Road, Warminster. PA 18974. USA Tel +215-674-6000 Fax +215-674-6394	ABB Australia Pty Ltd., Bapaume Road Moorebank NSW 2170 Tel +61-2-9821-0111 Fax +61-2-9821-0950	ABB Limited, Dranselder Str2 D-37070 Gottingen Germany Tel +49 0551 905 0 Fax +49 0551 905 777

CALMASTER HELPLINE
Email : calmaster@gb.abb.com or calmaster@us.abb.com

QSTA1138 Iss. 9

```
Printed Output From File
"G:\SERVIC~1\CALIBR~1\FACTOR~1\QLD\HV
AC-H~1\2694935.MAG"
Program v1.00 (30/08/1999) (WIN-PC)
File Produced : 26/07/04 9:28:56 AM

** Display Menu **
------------------
Display Mode       = 0
Display Resolution = 1

** Flow Menu **
---------------
Flow Range       = 600.00000
Flow Units       = Ltr
Flow Multiplier  = x1
Flow Time        = s
Flow Response    = 3
Flow Probe Ins   = 1.00000
Flow Probe Prof  = 1.00000
Flow Cutoff      = 3

** Analog Menu **
-----------------
Analog FSD     = 20
Analog Zero    = 4
Analog Dir Fwd = 1
Analog Dir Rev = 0
Analog No. 2   = 100.00000

** Pulse Menu **
----------------
Pulse Factor = 0.00999
Pulse Cutoff = 0
Pulse Max    = 800
Pulse Idle   = 1
Pulse Size   = 0

** Totaliser Menu **
--------------------
Totaliser Units      = Ltr
Totaliser Multiplier = k
Totaliser Clear Enab = 0

** Alarm No.1 Menu **
---------------------
Alarm No.1 Idle      = 1
Alarm No.1 Enable    = 1
Alarm No.1 Fault     = 1
Alarm No.1 Forward   = 0
Alarm No.1 Reverse   = 0
Alarm No.1 Cutoff    = 0
Alarm No.1 MtSensor  = 1
Alarm No.1 Hi        = 0
Alarm No.1 Lo        = 0
Alarm No.1 Analog    = 0
Alarm No.1 Pulse     = 0

** Alarm No.2 Menu **
---------------------
Alarm No.2 Idle      = 1
Alarm No.2 Enable    = 1
Alarm No.2 Fault     = 0
Alarm No.2 Forward   = 0
Alarm No.2 Reverse   = 1
Alarm No.2 Cutoff    = 0
Alarm No.2 MtSensor  = 0
Alarm No.2 Hi        = 0
Alarm No.2 Lo        = 0
Alarm No.2 Analog    = 0
Alarm No.2 Pulse     = 0

** Alarm Trip Menu **
---------------------
Alarm Trip Hi   = 110
Alarm Trip Lo   = -110
Alarm Trip Hyst = 1
Alarm Trip Disp = 0

** Input Menu **
----------------
Input Clr
Input Idle  = 0

** MtSensor Menu **
-------------------
MtSensor Trip = 50

** Sensor Menu **
-----------------
Sensor Number   = P/26949/3/5
Sensor Tag      = 5428814
Sensor Size     = 350
Sensor FACTOR 1 = 1.40352
Sensor FACTOR 2 = 2
Sensor FACTOR 3 = 5
Sensor FACTOR 4 = 1.00000

<<== END OF FILE ==>>
```

QST … sue 2

World Flow T …nology Centres

ABB

ABB Automation
Oldends Lane, Stonehouse
Gloucestershire, GL10 3TA, ENGLAND
Tel: +44 (0) 1453 826661
Fax: +44 (0) 1453 821121
e-mail: flow@gb.abb.com

ABB Automation Inc.
125 East Country Line Road
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Tel: +1 215 674 6000
Fax: +1 215 674 6394

ABB Automation
P.O. Box 2083
Taren Point NSW 2229 AUSTRALIA
Tel: +61 2 540 0000
Fax: +61 2 540 0001

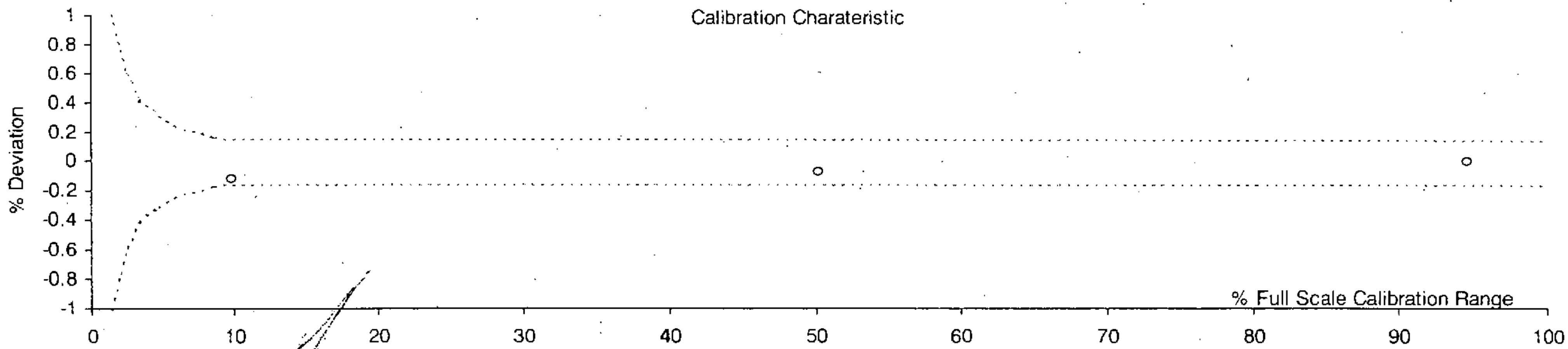
ABB Automation GmbH
Dransfelder Str. 2
D-37079 Göettingen GERMANY
Tel: +49 (0) 551 905212
Fax: +49 (0) 551 905711

Customer name: ABB AUSTRALIA PTY LTD
Customer ref. : 5145943
Serial number : P/26949/3/5
Order reference : EXP/P/26949/NKM
Meter type : MagMaster
Tag Number :

Meter code : MF/F351Z4110A005ER1301111
Calibration output : Digital
Customer full scale : 300.000 l/s
Calibration range : 500.00 l/s
Meter bore : 350 mm

Certificate number : 04/55733
Date of calibration : 11 Mar 2004
Test plant : Rig 9 9000m³/h
Sensor factor 1 : 1.4035
Sensor factor 2/3/4: 2 / 5 / 1.0000
Transmitter No : vkh06125

		Reference								Meter Under Test		
Test Run number	Run Time sec	Water Temp °C Int	Ext	Stream 1 l/s	Stream 2 l/s	Stream 3 l/s	Stream 4 l/s	Stream 5 l/s	Total Flow l/s	Flowrate l/s	% Cal. range	% Error
1	300	19.6	19.6	412.777	0	0	60.277	0	473.054	473.07	94.6	0
2	300	19.6	19.5	219.661	0	0	31.090	0	250.751	250.575	50.1	-0.07
3	300	19.4	19.6	0	0	0	49.181	0	49.181	49.122	9.8	-0.12



Calibrator SKRJ

Approved by

Witnessed by

Page 1 of 1

VEGA

Prüfzertifikat

für Druckmessumformer

Test certificate for pressure transmitters

9001 Q CE

VEGA bestätigt, dass die zur Qualitätsprüfung des Erzeugnisses eingesetzten Messmittel gültig kalibriert und auf nationale Normale der Physikalischen Technischen Bundesanstalt (PTB) rückführbar sind.
VEGA confirms that all instruments used to assure the quality of our products are calibrated and traceable to national standards of PTB (Physikalischen Technischen Bundesanstalt)

VEGA Grieshaber KG, Am Hohenstein 113, 77761 Schiltach, Tel. 0 78 36/50-0, Fax. 0 78 36/50 201

Druckmessumformer / Pressure transmitter:	BAR64
Messbereich / Meassuring range:	-1 bis/to 10,0bar rel. -100 bis/to 1000 kPa rel.
Seriennummer / Series no.:	14447963
Ausgang / Output:	4 ... 20mA, HART
Zulassungen / Approvals:	OHNE

Kundennummer Customer ID	44741
Auftragsnummer Order number	1212305
Auftragsposition Order position	1

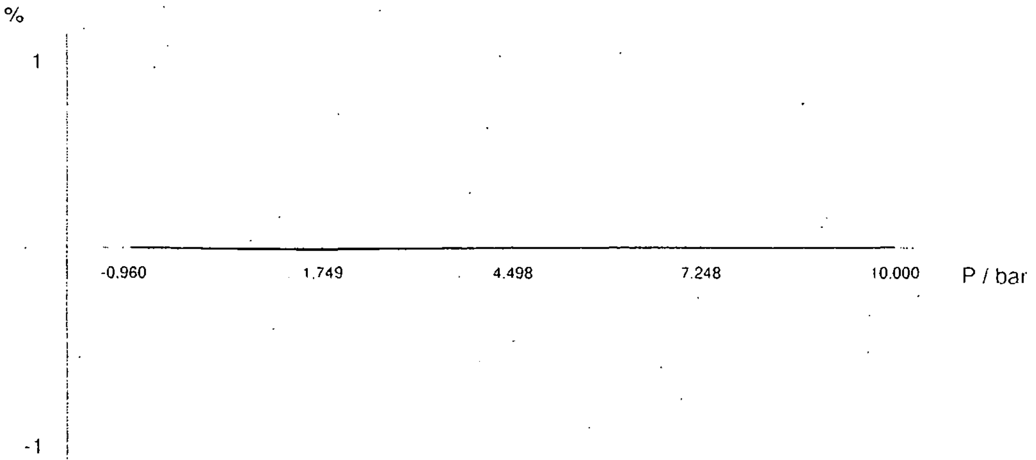
Kennwerte / Characteristics: -0,960 bis/to 10,000 bar rel.

0,36 bis/to 100,01 %

Kennliniencharakteristik / Output characteristics:

max. zul. Abweichung bezogen auf Messbereich: < 0,08 %
/ Dev. in linearity rel. to measuring range

Ref.-Druck / Ref. pressure [bar]:	-0,960	1,749	4,498	7,248	10,000
Soll-Ausgang / Ideal output [%]:	0,36	24,99	49,99	74,99	100.01
Ist-Ausgang / Real output [%]:	0,36	24,98	49,99	74,99	100.01
Abweichung / Accuracy [%]:	0,00	-0,01	0,00	0,00	0.00



Temperatureinfluss
/ Temperature influence:

Temperaturfehler bei 0 bar rel.
/ Temperature accuracy at 0 bar rel.

Bezogen auf den Messbereich / Related to the measuring range

Bezugstemperatur 20 °C / Ref. temperature 20 °C

Temperatur [°C] Temperature	0	20	60	100
Ist-Ausgang [%] Real output	9,07	9,09	9,09	9.04
Abweichung [%] Accuracy	-0,01	0,00	0.00	-0.05

Datum / Date: 06.07.2005

Unterschrift / Signature:

4.5 Instrumentation Calibration and Commissioning

4.5.1 Purpose

Pressure transmitter and flowmeter are to be calibrated and commissioned on site after installation to ensure correct installation and operation.

4.5.2 Scope

Representatives from Vega and ABB will calibrate and commission the instrumentation on site. They will provide certifying documents to confirm valid installation and calibration, which shall be similar to the factory calibration certificates supplied with each product.

Flowmeter to be calibrated for a maximum flow of 500 L/s.
Pressure transmitter to be calibrated for a maximum head pressure of 100 m.

4.5.3 Procedures

<u>Flowmeter</u>

1. Check unit for correct installation and wirings.
2. Program unit – flow measurement, flow range, analog output, etc.
3. Run CalMaster Verification Program to calibrate unit.
4. Produce CalMaster Verification Certification.

<u>Pressure Transmitter</u>

Utilising a hand pump test bucket and calibrated gauge, the Vega pressure sensor shall be induced to several test points pressures:

1. Induce sensor to **300kPa** on calibrated gauge, record and verify reading in pressure transmitter.
2. Induce sensor to **600kPa** on calibrated gauge, record and verify reading in pressure transmitter.
3. Induce sensor to **900kPa** on calibrated gauge, record and verify reading in pressure transmitter

If there are major indifferences between readings from the pressure transmitter to the calibrated pressure gauge, Vega shall conduct on site calibration of the instrument, with the following procedures:

1. Connect to Vega sensor with laptop at point of installation.
2. Check process is empty or not running.
3. Apply power to Vega device.
4. Calibrate instrument and scale for correct output
5. Check mA output by Vega device while process is empty or not operational.
6. Start process or fill and record data.
7. Check process is full or fully operational and check mA output.
8. Save data collected during commissioning of instrument.
9. Stop process for safety and disconnect Vega interface software.
10. Issue calibration certificate or what was found on that day at that time.

< Factory Calibration Certificates Attachment >

< ABB Flowmeter Calibration Verification Certificate Attachment>

< Pressure Transmitter Calibration Verification Record Attachment>

< Calibrated Pressure Gauge Calibration Report Attachment >

5.1

5. COMMISSIONING

5.1 Switchboard Functional Testing

5.1.1 Purpose

The switchboard is to be tested for every real life scenarios to ensure all aspect of the functional specification has been met.

5.1.2 Scope

Every scenario and device shall be tested, and associated control and monitoring signals back to PLC/RTU are valid. All possible faults/alarms shall be simulated and tested.

The tests is broken down into the following segments:

- Pumps in Local – check operation of pumps in local control;
- Pumps in Remote – check operation of pumps in remote auto control including surcharge imminent alarm and pump faults simulation;
- Pumps Status – check status of pumps in operation, ie. moisture in oil, thermistor, reflux valve microswitches, emergency stops;
- Sump Pump – check manual and auto operation of sump pump including sump and dry well alarms simulation;
- Other I/Os – check functionality of miscellaneous I/Os;
- Operational Checks – check other equipment are operational – building services, odour control, cathodic protection;
- Generator – simulate mains failure and check backup generator maintain station operation, check Brisbane Water control room remote start/stop of generator.

HVAC to conduct and witness the test along with the control system being monitored by Brisbane Water.

5.1.3 Procedures

Procedures for conducting the test are detailed in the test sheets.

< Switchboard Functional Test Sheets Attachment >

HVAC hps

COMMISSIONING SWITCHBOARD FUNCTIONAL TEST SHEET

CONTRACT NO.	BW.30079-02/03	SW.BOARD NAME	SP103
JOB NUMBER	3251Q	LOCATION	Heroes Avenue, Taringa
MANUFACTURER	MPA Engineering	DRAWING NUMBER	486/5/7-LIO10 to 486/5/7-LIO30
CUSTOMER REF.	Brisbane Water	FED FROM	New 750 KVA PMT

	DETAIL	OK	COMMENTS
	Pumps in Local		
1	Allow well to fill to a reasonable level (ie. above PID setpoint and below Start Duty 2) a~~nd fully open the discharge throttling valve for the tests~~.		
2	Have station in REMOTE and pumps will start automatically according to well level	✓	09/08/05
3	Observe pressing all 3 pumps START pushbuttons have no effect	✓	"
4	Switch station to LOCAL and check all pumps stop operation	✓	"
5	Push pump 1 START pushbutton, and observe pump 1 operates	✓	"
6	Observe pump 1 speed can be adjusted via its potentiometer	✓	"
7	Push pump 1 STOP pushbutton, and observe pump 1 stops	✓	"
8	Push pump 2 START pushbutton, and observe pump 2 operates	✓	"
9	Observe pump 2 speed can be adjusted via its potentiometer	✓	"
10	Push pump 2 STOP pushbutton, and observe pump 2 stops	✓	"
11	Push pump 3 START pushbutton, and observe pump 3 operates	✓	"
12	Observe pump 3 speed can be adjusted via its potentiometer	✓	"
13	Push pump 3 STOP pushbutton, and observe pump 3 stops	✓	"
14	At no time should 3 pumps operate simultaneously (auto interlock ???)	✓	"
	Pumps in Remote		
1	Switch station to REMOTE mode and check pumps start/stop to setpoints ~~with discharge throttling valve fully opened:~~	✓	09/08/05 12:53pm fill well
	A. One pump starts when wet well level rises to START DUTY A P2 started @ 28Hz	✓	~~09/08/05 12:55pm~~ 12:55
	B. Duty A pump runs varibly to keep wet well level at PID SETPOINT	✓	09/08/05
	C. Second pump starts when wet well level rises to START DUTY B	✓	09/08/05 1:13pm P1 on
	D. Duty B pump stops when wet well level drops to STOP DUTY B	✓	10/08/05
	E. Duty A pump stops when wet well level drops to STOP DUTY A	✓	10/08/05
2	When two pumps are running, simulate Duty A pump failure and observe standby pump activates and becomes Duty A pump, check its operation	✓	09/08/05
3	When two pumps are running, simulate Duty B pump failure and observe standby pump activates and becomes Duty B pump, check its operation	✓	09/08/05
4	Check failed pumps reset ok	✓	09/08/05
5	Simulate SURCHARGE IMMINENT ALARM and observe station operation: ✓ Calibrated	on	09/08/05
	A. Surcharge Imminent relay ON, alarm signalled to PLC	✓	09/08/05
	B. 2 duty pumps run at maximum speed	✓	10/08/05
6	With one duty pump running, simulate PUMP BLOCKAGE by closing discharge throttling valve and check station operation:		
	A. VSD driving duty pump trips with fault (eg. Overcurrent, motor overloaded alarms)		
	B. Duty pump faults, and PLC should start up standby pump		
	C. Immediately open discharge throttling valve and reset faulted pump		

PRINT NAME	SIGNATURE	DATE	COMMENTS
INSPECTED BY Reg McGirr	[signature]	9/08/05	
APPROVED BY			SHEET 1

HVAC hps

	DETAIL	OK	COMMENTS
	Pumps Status		
1	Observe that lamp status indicates correct state of motors at all times	✓	09/08/05
2	Observe the hours run meters operate correctly on all pumps	✓	09/08/05
3	Observe cubicle fan operates and record their thermostat settings:		
	A. Pump 1 25 ~~30~~ degrees	✓	09/08/05
	B. Pump 2 25 ~~30~~ degrees	✓	"
	C. Pump 3 25 ~~30~~ degrees	✓	"
4	Check and verify motor thermistors functionality on all pumps	✓	09/08/05
5	Check and verify motor moisture in oil sensor functionality on all pumps	✓	13/08/05
6	Check and verify reflux valve microswitches functionality on all pumps	✓	08/08/05
7	Check all MCC and field emergency stops functionality	✓	09/08/05
	Sump Pump		
1	Push sump pump START pushbutton and observe sump pump starts	✓	Completed in SAT
2	Push sump pump STOP pushbutton and observe sump pump stops	✓	
3	Fill sump and observe sump pump starts/stops automatically according to sump level	✓	
4	Simulate sump pump FAULT by tripping its overload relay or MCB	✓	
5	Reset fault and check operation	✓	
6	Observe sump pump indication light indicates correct state of sump pump at all times	✓	
7	Fill sump to high level alarm point and observe DRY WELL FLOODED HIGH LEVEL ALARM triggered to PLC	✓	10/08/05
8	Simulate DRY WELL FLOODED HI HI LEVEL ALARM and observe result - station should lock out	✓	10/08/05
	Other I/Os		
1	Simulate HARMONIC FILTER FAULT INDICATION ALARM and check result	✓	10/08/05
2	Check SITE ATTENTION ALARMS and associated RESET pushbutton are functional	✓	10/08/05
3	Check CATHODIC PROTECTION UNIT I/O signals are valid to/from RTU		No Cathodic I/Os
4	Check surcharge imminent probe and alarm is operational	✓	09/08/05
5	Check wet well wash solenoid is functional	✓	09/08/05
6	Check flow meter analogue input into PLC	✓	"
7	Check pipe pressure transmitter analogue input into PLC	✓	"
8	Check wet well level transmitter analogue input into RTU and PLC	✓	"
9	Fail DC supply and check backup batteries supply to RTU and other DCs	✓	Completed in SAT
10	Check RTU radio and comms back to BW Control Room are functional	✓	09/08/05
	Operational Checks		
1	Check vent fan is operational	✓	Completed in SAT
2	Check switchroom lightings is operational via switchroom light switches	✓	
3	Check switchroom GPOs are operational	✓	
4	Check odour control unit ~~is powered~~ can be powered	✓	
5	Check cathodic protection unit is powered	✓	

W. WONG [signature] 09/08/05

PRINT NAME	SIGNATURE	DATE	COMMENTS
INSPECTED BY	Reg McGirr [signature]	9/08/05	E Stops during Pumps at 50 Hz cause VSD Alarm 7 - DC Link Overvoltage voltage = 808 V
APPROVED BY			SHEET 2

Page 2 of 3 Date Printed: 15/07/2005 Heroes Ave Commissioning.xls

HVAC hps

	DETAIL	OK	COMMENTS
	Generator		
1	When station is in REMOTE and single pump is operating, simulate site mains failure by isolating main switch and observe results:	✓	11/08/05
	A. Observe generator starts up, and generator running indicator on	✓	"
	B. Observe generator continues operation of station	✓	"
	C. Simulate site mains restoration by closing main switch	✓	"
	D. Observe generator shuts down and ATS transfer power back to mains supply	✓	"
2	When station is in REMOTE and two pumps are operating at maximum speed, simulate site mains failure by isolating main switch and observe results:	✓	"
	A. Observe generator starts up, and generator running indicator on	✓	"
	B. Observe generator continues operation of station	✓	"
	C. Simulate site mains restoration by closing main switch	✓	"
	D. Observe generator shuts down and ATS transfer power back to mains supply	✓	"
3	Test generator remote start/stop operations are OK - BW control room to issue commands	✓	"

PRINT NAME	SIGNATURE	DATE	COMMENTS
INSPECTED BY	Reg McGinn	16/08/05	
APPROVED BY			SHEET 3

Page 3 of 3 Date Printed: 15/07/2005 Heroes Ave Commissioning.xls

5.2 Pump Performance Testing

5.2.1 Purpose

The purpose of this test is to verify performances of the pumps are valid for the pump curves specified for the contract, and supplied by the manufacturer.

5.2.2 Scope

Grundfos will attend the test and verify all pumps satisfy the latest pump selection schedule/curve (dated 02/07/2004) and factory certifying documents. Copies of these documents are attached. Data taken from the tests would be used to draw up site pump curves.

All tests will be conducted in LOCAL mode to allow manual start/stop of the pumps, while hand start/stop of the VSDs would be required to run pumps at the desired speeds. The following data shall be recorded on the Pump Performance Testing Record to verify performance conforms to pump curves and specifications:

- Speed (in **Hz**)
- Current (in **A**)
- Power (in **kW**)
- Delivery (in **L/sec**)
- Pressure (in **m**)
- Well Level at operation (**% / mAHD**)

The pumps shall be tested and verified to the following points:

A 4 points tested at 50Hz for single pump operation on each pump

B 2 points tested at 40Hz for single pump operation on each pump

C 2 points tested at 33Hz for single pump operation on each pump

D 4 points tested at 28Hz for single pump operation on each pump

E 4 points tested at 50Hz on two pumps running for one combination (including running pumps under generator power)

Date: 8/10/05 Recorded by: W. WONG Wet well probe: 0% at -4.869 mAHD, 100% at 3.131 mAHD

Time	Station Mode	Generator Running	Pump No 1 (Grundfos serial number: 182521)			Pump No 2 (Grundfos serial number: 182523)			Pump No 3 (Grundfos serial number: 182522)			Pump Delivery (Q)	Pipe Pressure (H)	Wet Well Level	Comments / Pump Performance Test Point
am / pm	Local / Remote	Yes / No	Hz	A	kW	Hz	A	kW	Hz	A	kW	L/sec	m *	%	Test point if any (eg. P1 50Hz 4 points test)
3:28 pm	Local	No	40	130	55							224	8 + 8	26	P1 40Hz 220L/s
3:40 pm	Local	No	40	121	50							140.7	18.65+8	26	P1 40Hz 140L/s
3:52 pm	Local	No	~~40~~	~~124~~	~~52~~	40	124	52				140.3	18.6+8	25	P2 40Hz 140L/s
3:59 pm	Local	No	~~40~~			40	131	55				219.3	8.8 + 8	24	P2 40Hz 220L/S
4:06 pm	Local	No	~~40.1~~						40.1	129	55	218	8.8 + 8	24	P3 40Hz 220L/S
4:12 pm	Local	No							40.1	121	50	140.8	18.8 + 8	25	P3 40Hz 140L/S
4:19 pm	Local	No							33.1	98	31	175.4	4.7 + 8	25	P3 33Hz 180L/S
4:29 pm	Local	No							33.1	90	27	102	12.7 + 8	25	P3 33Hz 100L/S
4:34 pm	Local	No				33.1	94	29				101	12.65 + 8	26	P2 33Hz 100L/S
4:40 pm	Local	No				33.1	100	32				176	5 + 8	25	P2 33Hz 180L/S
4:47 pm	Local	No	33.1	99	31							175	5+8	26	P1 33Hz 180L/S
4:53 pm	Local	No	33.1	91	27							100	12.7+8	26	P1 33Hz 100L/S

9/08/05

4:58 P1 Shut Down, 40 & 33Hz Tests Completed

* When pumps are off, pressure + x @ 1.28m read *

SP103 HEROES AVENUE PUMP PERFORMANCE TESTING RECORD

*Note: "+8m" is an approximate R.L. figure and not used for calculations

5:00 P1 Ramp Up 20S, P1 Ramp Down on STOP 20s

Date: 8/8/05 Recorded by: W. WONG Wet well probe: 0% at -4.869 mAHD, 100% at 3.131 mAHD

Time	Station Mode	Generator Running	Pump No 1 (Grundfos serial number: 182521)			Pump No 2 (Grundfos serial number: 182523)			Pump No 3 (Grundfos serial number: 182522)			Pump Delivery (Q)	Pipe Pressure (H)	Wet Well Level	Comments / Pump Performance Test Point
am / pm	Local / Remote	Yes / No	Hz	A	kW	Hz	A	kW	Hz	A	kW	L/sec	m *	%	Test point if any (eg. P1 50Hz 4 points test)
am 2:25 pm	Local Remote	Yes No												26	P3 50Hz 100L/S
am pm	Local Remote	Yes No													Reflux switch not actuating
am 2:41 pm	Local Remote	Yes No				~~50~~	~~142~~	~~78~~	50	142	78	101.4	42.6+8	26	Fixed Reflux ✓
am 2:46 pm	Local Remote	Yes No				~~50~~			50	170	100	170	33.45+8	~~26~~ 25	P3 50Hz 170L/S
am 2:53 pm	Local Remote	Yes No							50	183	111	257	19.8+8	24	P3 50HZ 250L/S
am 2:59 pm	Local Remote	Yes No							50	186	114	308	9.26+8	23-24	P3 50Hz 315L/S
am 3:04 pm	Local Remote	Yes No													P3 off, 50Hz tests done
am pm	Local Remote	Yes No													
am pm	Local Remote	Yes No													
am pm	Local Remote	Yes No													
am pm	Local Remote	Yes No													
am pm	Local Remote	Yes No													

Reg McG[illegible] 9/08/05

* Note: "+8m" is an aproximate R.L. figure and not used for calculations.

HVAC

SP103 HEROES AVENUE PUMP PERFORMANCE TESTING RECORD

hps

Date: 0/8/05 Recorded by: W. WONG Wet well probe: 0% at -4.869 mAHD, 100% at 3.131 mAHD

Time	Station Mode	Generator Running	Pump No 1 (Grundfos serial number: 182521)			Pump No 2 (Grundfos serial number: 182523)			Pump No 3 (Grundfos serial number: 182522)			Pump Delivery (Q)	Pipe Pressure (H)	Wet Well Level	Comments / Pump Performance Test Point
am / pm	Local / Remote	Yes / No	Hz	A	kW	Hz	A	kW	Hz	A	kW	L/sec	m *	%	Test point if any (eg. P1 50Hz 4 points test)
1:30 am pm	Local Remote	Yes No				50									P2 Reflux switch not actuating, fixed ✓
1:50 am pm	Local Remote	Yes No				50							3 + 8		Pumps low pressure, throttling valve too opened
2:00 am pm	Local Remote	Yes No	~~50~~			50	182	115				~~[illegible]~~ 308	8.4+8	26	P2 50Hz 315L/s
2:06 am pm	Local Remote	Yes No				50	183	113				248.2	21.26+8	25	P2 50Hz 250L/s
2:12 am pm	Local Remote	Yes No				50	170	103				170	32.9+8	25.5	P2 50Hz 170L/s
2:17 am pm	Local Remote	Yes No				50						101	42.3+8	25	P2 50Hz 100L/s
am pm	Local Remote	Yes No													
am pm	Local Remote	Yes No													
am pm	Local Remote	Yes No													
am pm	Local Remote	Yes No													
am pm	Local Remote	Yes No													
am pm	Local Remote	Yes No													

Rece McC[illegible]
9/08/05

R.L.
* Note: "+8m" is an approximate figure and not used for calculations.

HVAC **SP103 HEROES AVENUE PUMP PERFORMANCE TESTING RECORD** hps

32 ... total

Date: 8/8/05 Recorded by: William Wong Wet well probe: 0% at -4.869 mAHD, 100% at 3.131 mAHD

Time	Station Mode	Generator Running	Pump No 1 (Grundfos serial number: 182521)			Pump No 2 (Grundfos serial number: 182523)			Pump No 3 (Grundfos serial number: 182522)			Pump Delivery (Q)	Pipe Pressure (H)	Wet Well Level	Comments / Pump Performance Test Point
am / pm	Local / Remote	Yes / No	Hz	A	kW	Hz	A	kW	Hz	A	kW	L/sec	m *	%	Test point if any (eg. P1 50Hz 4 points test)
10:45 am	Local	Yes	45	157	81.5							160	6.6 +8	28	P1 50Hz • Pressure is low
11:26 am	Local	Yes	45	156	80							248	13.3 +8	28	Close bypass valve • Pressure looks OK
11:30 am	Local	Yes	50	185	110							315	7.9 +8	28	P1 50Hz 315L/s
11:32 am	Local	Yes	50	182	110/115							246.3	22.3+8	28	P1 50Hz 250L/s
11:38 am	Local	Yes	50	168	100							173.7	32.5+8	26	P1 50Hz 170L/S (173.7L/S)
11:50 am	Local	Yes	50									75	≈50	26	Reflux 1 tripped P1
12:00 pm	Local	No													Adjust reflux switch to closer to valve close position (10 2c)
12:15 pm	Local	No	50	142	82							101	12.8+8	26	P1 50Hz 100L/s
am pm	Local Remote	Yes No													
am pm	Local Remote	Yes No													
am pm	Local Remote	Yes No													
am pm	Local Remote	Yes No													

Reg McGirr 9/08/05

* Note: "+8m" is an approximate R.L. figure and not used for calculations.

HVAC

SP103 HEROES AVENUE PUMP PERFORMANCE TESTING RECORD

hps

E. Two pumps 50Hz 4 points testing

1. Record wet well level.
2. Set discharge throttling valve fully open.
3. Start **Pump 1** and ramp to speed **50Hz**.
4. Start **Pump 2 or Pump 3** and ramp to speed **50Hz**.
5. Close discharge throttling valve to a flow of **480L/s**, run for 10 minutes to let it settle, record readings.
6. Set discharge throttling valve to a flow of **400L/s**, run for 10 minutes to let it settle, record readings.
7. Set discharge throttling valve to a flow of **350L/s**, run for 10 minutes to let it settle, record readings.
8. Set discharge throttling valve to a flow of **250L/s**, run for 10 minutes to let it settle, record readings.
9. Isolate main switch to simulate mains failure and continually run pumps under generator power, record readings.
10. Shut down the pumps.
11. Close main switch and restore Energex power.

< Pump Performance Testing Record Attachment >

< Pump Schedule/Curve and Factory Certifying Documents >

C. Single pump 33Hz 2 points testing

1. Record wet well level.
2. Set discharge throttling valve fully open.
3. Start **Pump 1** and ramp to speed **33Hz**.
4. With the discharge throttling valve fully open, record Q & H.
5. Close discharge throttling valve to a flow of **180L/s**, run for 10 minutes to let it settle, record readings.
6. Close discharge throttling valve to a flow of **100L/s**, run for 10 minutes to let it settle, record readings.
7. Shut down Pump 1, and repeat same process for Pump 2 and Pump 3.

D. Single pump 28Hz 4 points testing

1. Record wet well level.
2. Set discharge throttling valve fully open.
3. With the discharge throttling valve fully open, record Q & H.
4. Start **Pump 1** and ramp to speed **28Hz**.
5. Close discharge throttling valve to a flow of **170L/s**, run for 10 minutes to let it settle, record readings.
6. Close discharge throttling valve to a flow of **130L/s**, run for 10 minutes to let it settle, record readings.
7. Close discharge throttling valve to a flow of **90L/s**, run for 10 minutes to let it settle, record readings.
8. Close discharge throttling valve to a flow of **50L/s**, run for 10 minutes to let it settle, record readings.
9. Shut down Pump 1, and repeat same process for Pump 2 and Pump 3.

5.2.3 Procedures

A. Single pump 50Hz 4 points testing

1. Record wet well level.
2. Set discharge throttling valve fully open.
3. Start **Pump 1** and ramp to maximum speed **50Hz**.
4. With the discharge throttling valve fully open, record Q & H.
5. Close discharge throttling valve to a flow of **315L/s**, run for 10 minutes to let it settle, record readings.
6. Close discharge throttling valve to a flow of **250L/s**, run for 10 minutes to let it settle, record readings.
7. Close discharge throttling valve to a flow of **170L/s**, run for 10 minutes to let it settle, record readings.
8. Close discharge throttling valve to a flow of **100L/s**, run for 10 minutes to let it settle, record readings.
9. Shut down Pump 1, and repeat same process for Pump 2 and Pump 3.

B. Single pump 40Hz 2 points testing

1. Record wet well level.
2. Set discharge throttling valve fully open.
3. With the discharge throttling valve fully open, record Q & H.
4. Start **Pump 1** and ramp to speed **40Hz**.
5. Close discharge throttling valve to a flow of **220L/s**, run for 10 minutes to let it settle, record readings.
6. Close discharge throttling valve to a flow of **140L/s**, run for 10 minutes to let it settle, record readings.
7. Shut down Pump 1, and repeat same process for Pump 2 and Pump 3.

Date: 09/08/05 Recorded by: W. WONG Wet well probe: 0% at -4.869 mAHD, 100% at 3.131 mAHD

Time	Station Mode	Generator Running	Pump No 1 (Grundfos serial number: 182521)			Pump No 2 (Grundfos serial number: 182523)			Pump No 3 (Grundfos serial number: 182522)			Pump Delivery (Q)	Pipe Pressure (H)	Wet Well Level	Comments / Pump Performance Test Point
am / pm	Local / Remote	Yes / No	Hz	A	kW	Hz	A	kW	Hz	A	kW	L/sec	m	%	Test point if any (eg. P1 50Hz 4 points test)
am 12:05 pm	Local Remote	Yes No											1.80		Prior to test
am 12:10 pm	Local Remote	Yes No	50	181	100	50	181	100				481	G 23+ R.L.	29	2 Pumps @ 50 Hz, 480 L/s
am 12:21 pm	Local Remote	Yes No	50	176	105	50	178	107				~~405~~ 406	G 28.9+ R.L.	29	2 Pumps @ 50 Hz, 400 L/s
am 12:29 pm	Local Remote	Yes No	50	171	101	50	171	101				356	G 32.3+ R.L.	29	2 Pumps @ 50 Hz, 350 L/s
am 12:35 pm	Local Remote	Yes No	50	154	90	50	154	90				255	G 40.2+ R.L.	30	2 Pumps @ 50Hz, 250 L/s
am 12:38 pm	Local Remote	Yes No											G 1.9+ ~~R.L.~~		P1/P2 STOP
am ~~12:41 pm~~	Local ~~Remote~~	Yes ~~No~~	~~28~~												~~P1 28 Hz 170 L/s~~
am pm	Local Remote	Yes No													
am pm	Local Remote	Yes No													
am pm	Local Remote	Yes No													
am pm	Local Remote	Yes No													
am 1:15 pm to 1:30	Local Remote	Yes No	E-Stops on P1/2/3 actuated during each pump running at 50 Hz												

VSDs tripped on Alarm 7 (DC Link Overvoltage) - 808V recorded

Reg McGuire 9/08/05

HVAC

SP103 HEROES AVENUE PUMP PERFORMANCE TESTING RECORD

hps

Date: 04/08/05 Recorded by: W. WONG Wet well probe: 0% at -4.869 mAHD, 100% at 3.131 mAHD

Time	Station Mode	Generator Running	Pump No 1 (Grundfos serial number: 182521)			Pump No 2 (Grundfos serial number: 182523)			Pump No 3 (Grundfos serial number: 182522)			Pump Delivery (Q)	Pipe Pressure (H)	Wet Well Level	Comments / Pump Performance Test Point
am / pm	Local / Remote	Yes / No	Hz	A	kW	Hz	A	kW	Hz	A	kW	L/sec	m	%	Test point if any (eg. P1 50Hz 4 points test)
2:25 pm	Local	No	28	83	20							164	G 2.47+ R.L.	42	P1 28Hz - 170L/s
2:34 pm	Local	No	28	82	19							135.5	G 5.42+ R.L	43	P1 28Hz - 130L/s
2:38 pm	Local	No	28	77	17							85	G 9.6+ R.L.	43	P1 28Hz - 90L/s
2:43 pm	Local	No	28	68	14							51	G 11.8+ R.L.	43	P1 28Hz - 50L/s
2:48 pm	Local	No				28	68	14				50	G 11.7+ RL	43	P2 28Hz - 50L/s
2:53 pm	Local	No				28	77	17				89.4	G 9.2+ R.L.	43	P2 28Hz - 90L/s
2:58 pm	Local	No				28	81	19				129	G 6+ R.L	42	P2 28Hz - 130L/s
3:03 pm	Local	No				28	82	19				162	G 2.6+ R.L.	42	P2 28Hz - 170L/s
3:08 pm	Local	No				~~28~~	~~80~~	~~19~~	28	80	19	160.5	G 2.5+ RL	42.5	P3 28Hz - 170L/s
3:13 pm	Local	No				~~28~~	~~78~~	~~18~~	28	78	18	135	G 5.2+ R.L	42.5	P3 28Hz - 130L/s
3:17 pm	Local	No				~~28~~	~~74~~	~~16~~	28	74	16	86	G 9.45+ R.L.	42.5	P3 28Hz - 90L/s
3:22 pm	Local	No				~~28~~	~~67~~	~~14~~	28	67	14	55	G 11.6+ RL	42.5	P3 28Hz - 50L/s

Reg McG[illegible] 9/8/05

HVAC

SP103 HEROES AVENUE PUMP PERFORMANCE TESTING RECORD

hps

Facsimile

GRUNDFOS

GRUNDFOS PUMPS PTY LTD
PO Box 6033
Acacia Ridge DC QLD 4110
Australia

ACN 007 920 765
ABN 90 007 920 765

Telephone: (07) 3272 1980
Direct Line: (07) 3712 5930
Facsimile: (07) 3273 8735
Email: awhite@grundfos.com

To:	Graham James	**Company:**	HVAC
Fax:		**Phone:**	
From:	Andrew White	**Date:**	22 August 2005
Re:	Heroes Ave - Test results	**Pages:**	1

Graham, please find following calculations for each pump test.

1. 50, 40 and 33hz for each pump based on:
   a. Static Suction head to centre line of pump: (2.84m) – 24% Wet Well
   b. Friction losses through suction : 0.5m
   c. Friction losses through discharge: 1.5m
   d. Static head to gauge: 7.9m

   Total head added to gauge reading = 7.0m

2. 28 Hz each pump based on :
   a. Static Suction head to centre line of pump: (4.34m) – 29% Wet Well
   b. Friction Losses through suction : 0.5m
   c. Friction losses through discharge : 1.5m
   d. Static head to gauge: 7.9m

   Total head added to gauge reading = 5.5m

3. 50hz two pumps in parallel based on:
   a. Static suction head to centre line of pump: (3.24m) – 42% Wet Well
   b. Friction losses through Suction: 0.5m
   c. Friction losses through discharge: 1.5m
   d. Static head to gauge: 7.9m

   Total head added to gauge reading: = 6.6m

We hope this information clarifies our calculations.

Regards

Andrew White

BE > THINK > INNOVATE > GRUNDFOS

FAXED

Facsimile Message

To	**:**	BRISBANE WATER			
Attention	**:**	M. HERITAGE/R. MCGIRR	***Date***	**:**	12/08/05
From	**:**	GRAHAM JAMES	***Ref***	**:**	BRI050812_pump test curves.doc
			Fax No	**:**	
Subject	**:**	**PUMP TEST CURVES FOR HEROES AVENUE**			

Mike/ Reg,

Please find attached the pump test curves for the tests carried out on the 8th and 9th August 2005 at Heroes Avenue. These are a complete set based on the signed off test sheets with the correct head values for all readings.

Please disregard previous curves as they were not based on the signed off values.

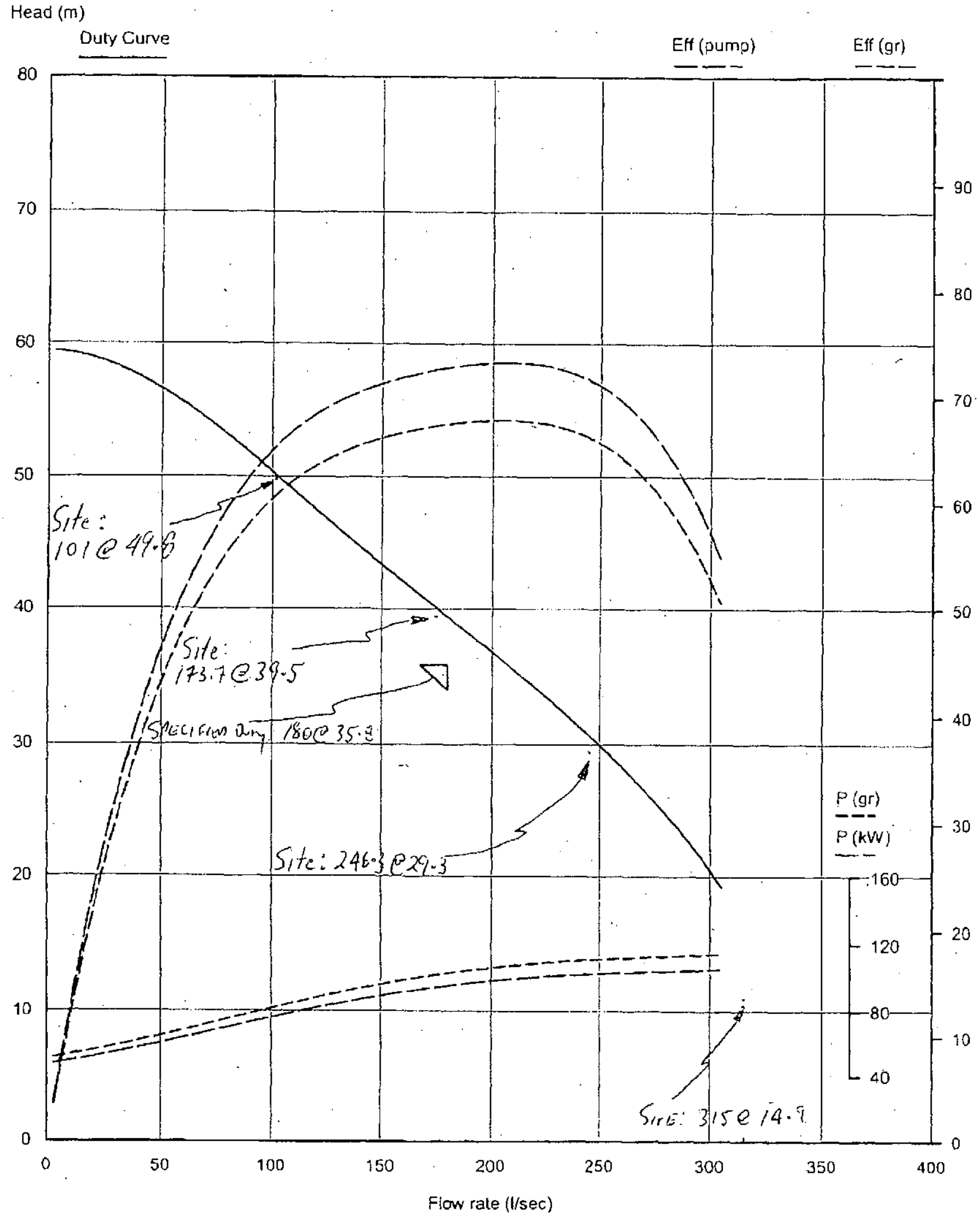
hope these will satisfy your requirements. If there are any issues with respect to these please advise me at your earliest opportunity and I will address these immediately.

Regards

Graham James
Project Manager

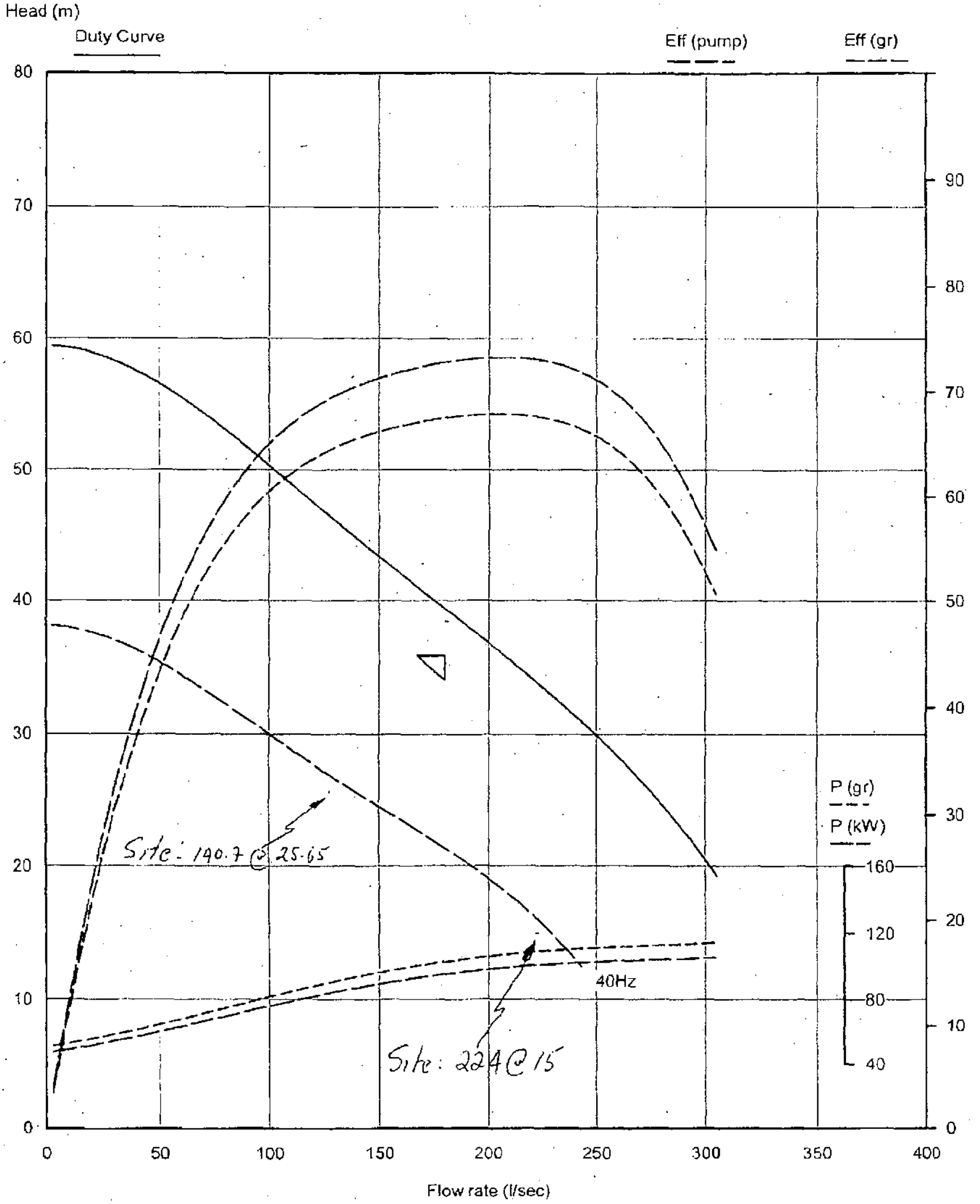
Site Results @ 50Hz – P1.

GRUNDFOS	S2-1154-M3 Project Ref P1/182521		Curve no: 943365 Pn 115 kW Nn 1475 1/min	
	REQUIRED DUTY	PUMP DUTY POINT DATA		
	Flow 180 l/sec	Flow 187 l/sec	P (pump) 96.7 kW	Eff (pump) 73.0 %
	Head 35.8 m	Head 38.5 m	P (gr) 104 kW	Eff (gr) 67.6 %
		Energy 155 kWh/1000m3		



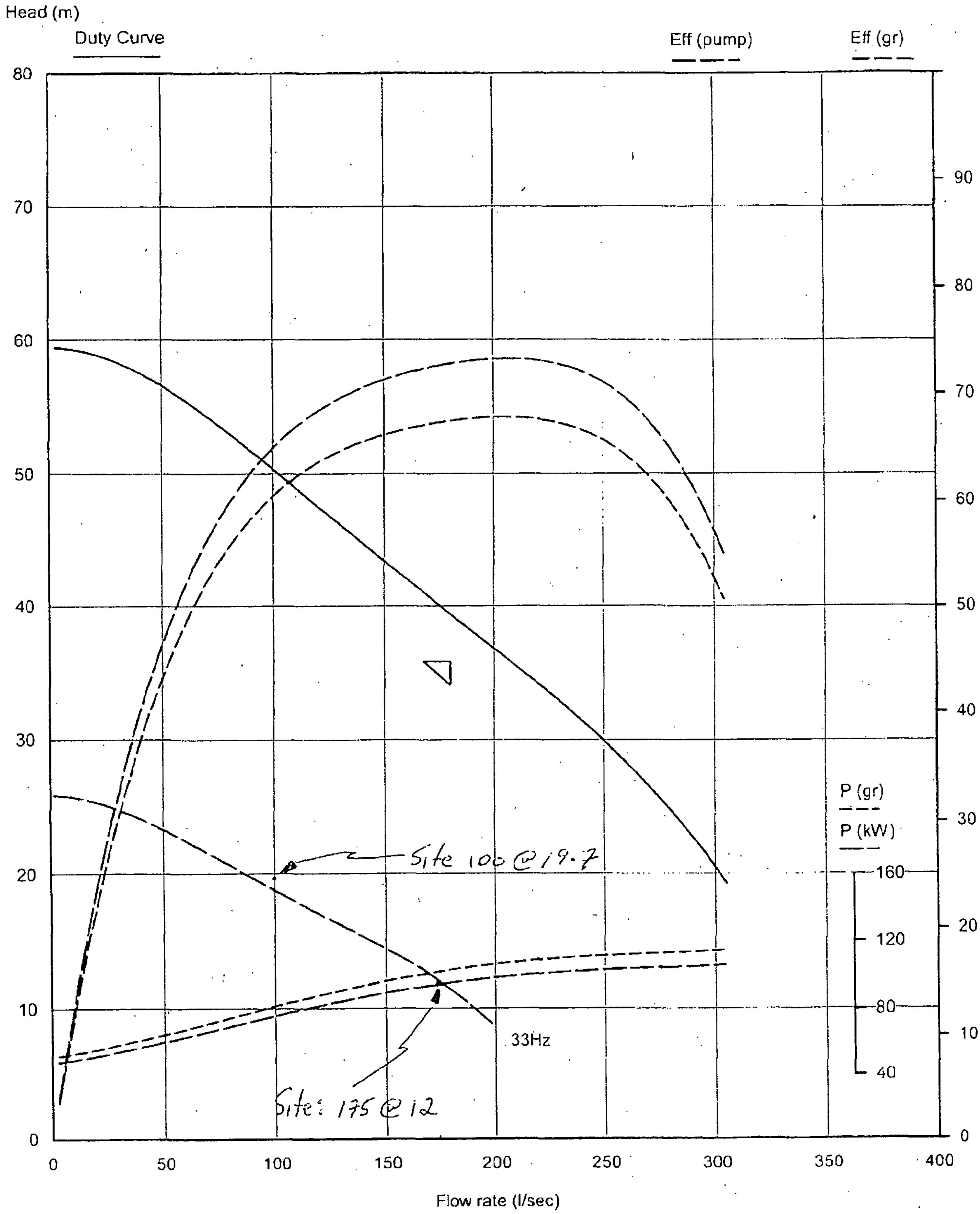
Site Results @ 40Hz – P1.

GRUNDFOS	S2-1154-M3 Project Ref P1/182521			Curve no: 943365 Pn 115 kW Nn 1475 1/min	
	REQUIRED DUTY	PUMP DUTY POINT DATA		P (pump)	96.7 kW
	Flow 180 l/sec	Flow	187 l/sec	Eff (pump)	73.0 %
	Head 35.8 m	Head	38.5 m	P (gr)	104 kW
		Energy	155 kWh/1000m3	Eff (gr)	67.6 %



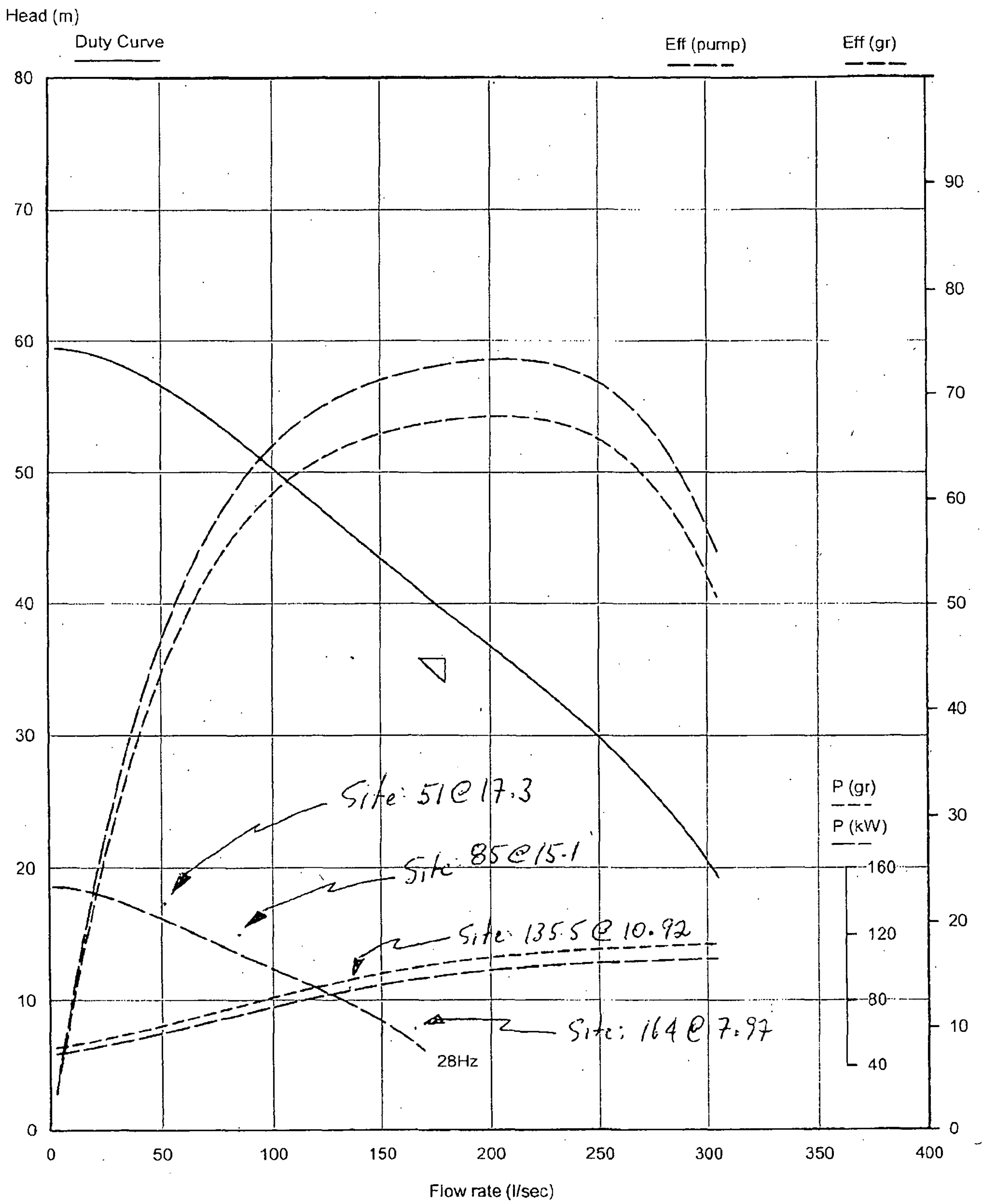
Site Results @ 33Hz – P1.

GRUNDFOS	S2-1154-M3 Project Ref P1/182521		Curve no: 943365 Pn 115 kW Nn 1475 1/min	
	REQUIRED DUTY	PUMP DUTY POINT DATA		
	Flow 180 l/sec	Flow 187 l/sec	Eff (pump)	73.0 %
	Head 35.8 m	Head 38.5 m	P (gr)	104 kW
		Energy 155 kWh/1000m3	Eff (gr)	67.6 %
			P (pump)	96.7 kW



Site Results @ 28 Hz – P1.

GRUNDFOS	S2-1154-M3		Curve no:	943365
	Project Ref P1/182521		Pn	115 kW
			Nn	1475 1/min
	REQUIRED DUTY	**PUMP DUTY POINT DATA**	P (pump)	96.7 kW
	Flow 180 l/sec	Flow 187 l/sec	Eff (pump)	73.0 %
	Head 35.8 m	Head 38.5 m	P (gr)	104 kW
		Energy 155 kWh/1000m3	Eff (gr)	67.6 %



Date: 8/2/05 Recorded by: William Wong Wet well probe: 0% at ________ mAHD, 100% at ________ mAHD

Time	Station Mode	Generator Running	Pump No 1 (Grundfos serial number: 182521)			Pump No 2 (Grundfos serial number: 182523)			Pump No 3 (Grundfos serial number: 182522)			Pump Delivery (Q)	Pipe Pressure (H)	Wet Well Level	Comments / Pump Performance Test Point
am / pm	Local / Remote	Yes / No	Hz	A	kW	Hz	A	kW	Hz	A	kW	L/sec	m	%	Test point if any (eg. P1 50Hz 4 points test)
10:45 am	Local	No	45	157	81.5							160	6.6+8	28	P1 50Hz • Pressure is low
11:36 am	Local	No	45	156	80							248	13.3+8	28	Close bypass valve • Pressure looks OK
11:30 am	Local	No	50	185	110							315	7.9+8	28	P1 50Hz 315L/s
11:32 am	Local	No	50	182	110-115							246.3	22.3+8	28	P1 50Hz 250L/s
11:38 am	Local	No	50	168	100							173.7	32.5+8	26	P1 50Hz 170L/S (173.7L/s)
11:50 am	Local	No	50									75	~50	26	Reflux 1 tripped P1
12:00 pm	Local	No													Adjust reflux switch to closer to valve close position (1/2)
12:15 pm	Local	No	50	142	82							101	42.8+8	26	P1 50Hz 100L/S
am / pm	Local / Remote	Yes / No													
am / pm	Local / Remote	Yes / No													
am / pm	Local / Remote	Yes / No													
am / pm	Local / Remote	Yes / No													

9/02/05

Reg McGuire

HVAC

SP103 HEROES AVENUE PUMP PERFORMANCE TESTING RECORD

hps

Date: [illegible]/05 Recorded by: W. WONG Wet well probe: 0% at ________ mAHD, 100% at ________ mAHD

Time	Station Mode	Generator Running	Pump No 1 (Grundfos serial number: 182521)			Pump No 2 (Grundfos serial number: 182523)			Pump No 3 (Grundfos serial number: 182522)			Pump Delivery (Q)	Pipe Pressure (H)	Wet Well Level	Comments / Pump Performance Test Point
am / pm	Local / Remote	Yes / No	Hz	A	kW	Hz	A	kW	Hz	A	kW	L/sec	m	%	Test point if any (eg. P1 50Hz 4 points test)
3:28 pm	Local	No	40	130	55							224	8+8	26	P1 40Hz 220L/S
3:40 pm	Local	No	40	121	50							140.7	18.65+8	26	P1 40Hz 140L/S
3:52 pm	Local	No	~~40~~	~~124~~	~~52~~	40	124	52				140.3	18.6+8	25	P2 40Hz 140L/S
3:59 pm	Local	No	~~40~~			40	131	55				219.3	8.8+8	24	P2 40Hz 220L/S
4:06 pm	Local	No	~~40~~						40.1	129	55	218	8.8+8	24	P3 40Hz 220L/S
4:12 pm	Local	No							40.1	121	50	140.8	18.8+8	25	P3 40Hz 140L/S
4:19 pm	Local	No							33.1	98	31	175.4	4.7+8	25	P3 33Hz 180L/S
4:29 pm	Local	No							33.1	90	27	102	12.7+8	25	P3 33Hz 100L/S
4:34 pm	Local	No				33.1	94	29				101	12.65+8	26	P2 33Hz 100L/S
4:40 pm	Local	No				33.1	100	32				176	5+8	25	P2 33Hz 180L/S
4:47 pm	Local	No	33.1	99	31							175	5+8	26	P1 33Hz 180L/S
4:53 pm	Local	No	33.1	91	27							100	12.7+8	26	P1 33Hz 100L/S

9/06/05

4:58 P1 Shut Down, 40 & 33Hz Tests Completed * When pumps are off, pressure tx @ 1.28m read *

SP103 HEROES AVENUE PUMP PERFORMANCE TESTING RECORD

HVAC hps

Ramp Up 20S. P1 Ramp Down on STOP 20s

UNCLEAR TEXT

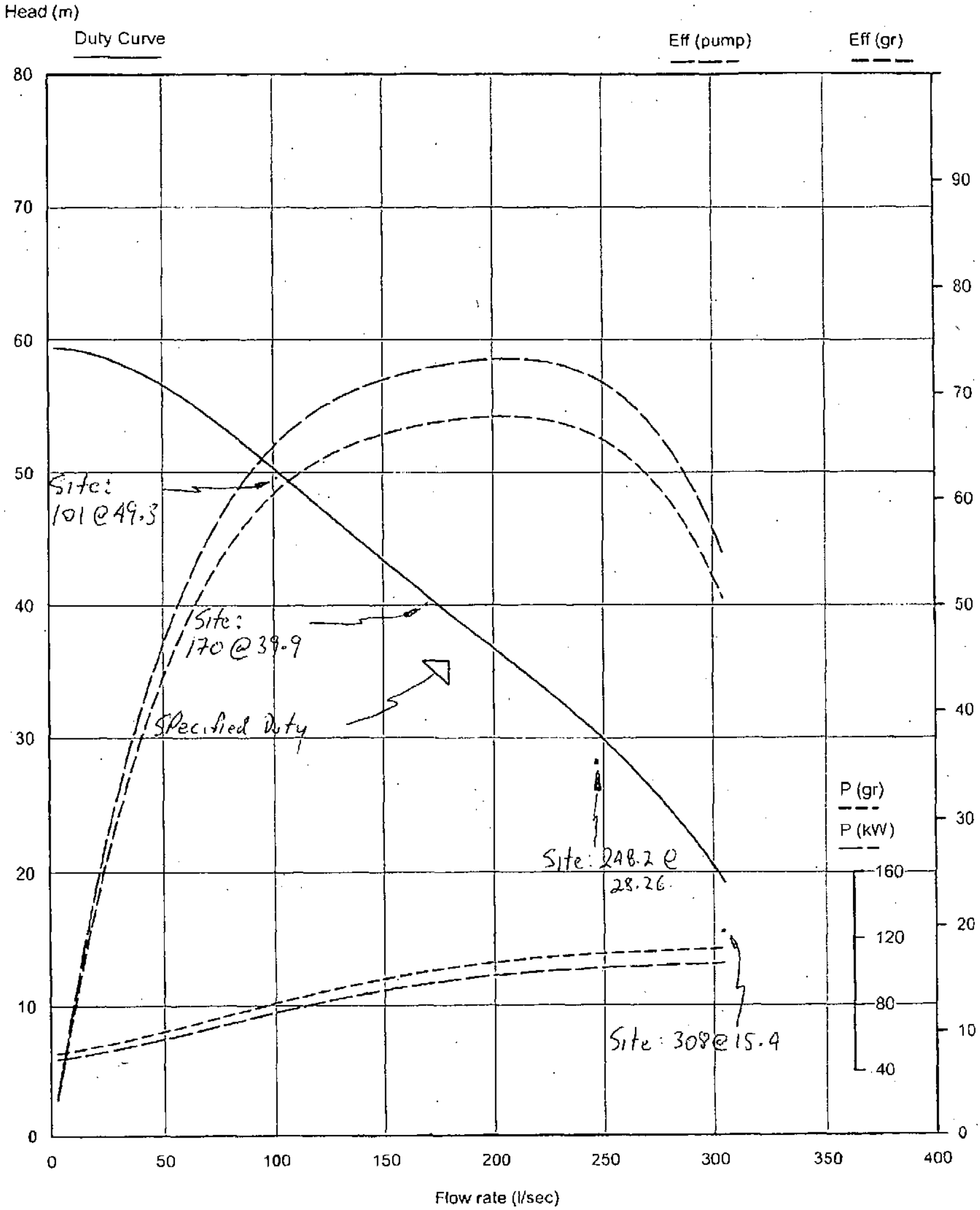
Date: [illegible] Recorded by: [illegible] Wet well probe: 0% at ______ mAHD. 100% at ______ mAHD

Time	Station Mode	Generator Running	Pump No 1 (Grundfos serial number: 182521)			Pump No 2 (Grundfos serial number: 182523)			Pump No 3 (Grundfos serial number: 182522)			Pump Delivery (Q)	Pipe Pressure (H)	Wet Well Level	Comments / Pump Performance Test Point
am / pm	Local / Remote	Yes / No	Hz	A	kW	Hz	A	kW	Hz	A	kW	L/sec	m	%	Test point if any (eg. P1 50Hz 4 points test)
2:25 pm	Local	No	25	33	20							164	G RL 2.47+	42	P1 25Hz - 160 L/s
2:34 pm	Local	No	25	32	19							135.5	G RL 3.42+	43	P1 25Hz - 135 L/s
2:38 pm	Local	No	25	17	17							85	G RL 10+	43	P1 25Hz - 90 L/s
2:43 pm	Local	No	25	20	14							51	G RL 11.3+	43	P1 25Hz - 50 L/s
2:45 pm	Local	No				25	25	14				56	G RL 11.7+	43	P2 25Hz - 50 L/s
2:52 pm	Local	No				25	77	17				114	G RL 9.21	43	P2 25Hz - 110 L/s
2:59 pm	Local	No				25	31	19				129	G RL 6+	42	P2 25Hz - 130 L/s
3:03 pm	Local	No				25	32	19				162	G RL 4.6+	42	P2 25Hz - 160 L/s
3:08 pm	Local	No				~~25~~	~~30~~	~~19~~	25	30	19	160.5	G RL 2.5+	42.5	P3 25Hz - 160 L/s
3:13 pm	Local	No				~~25~~	~~78~~	~~13~~	25	78	13	135	G RL 5.2	42.5	P3 25Hz - 130 L/s
3:17 pm	Local	No				~~25~~	~~74~~	~~16~~	25	74	16	86	G RL 9.45	42.5	P3 25Hz - 90 L/s
3:22 pm	Local	No				~~25~~	~~67~~	~~14~~	25	67	14	55	G RL 11.6	42.5	P3 25Hz - 50 L/s

[illegible] [illegible]

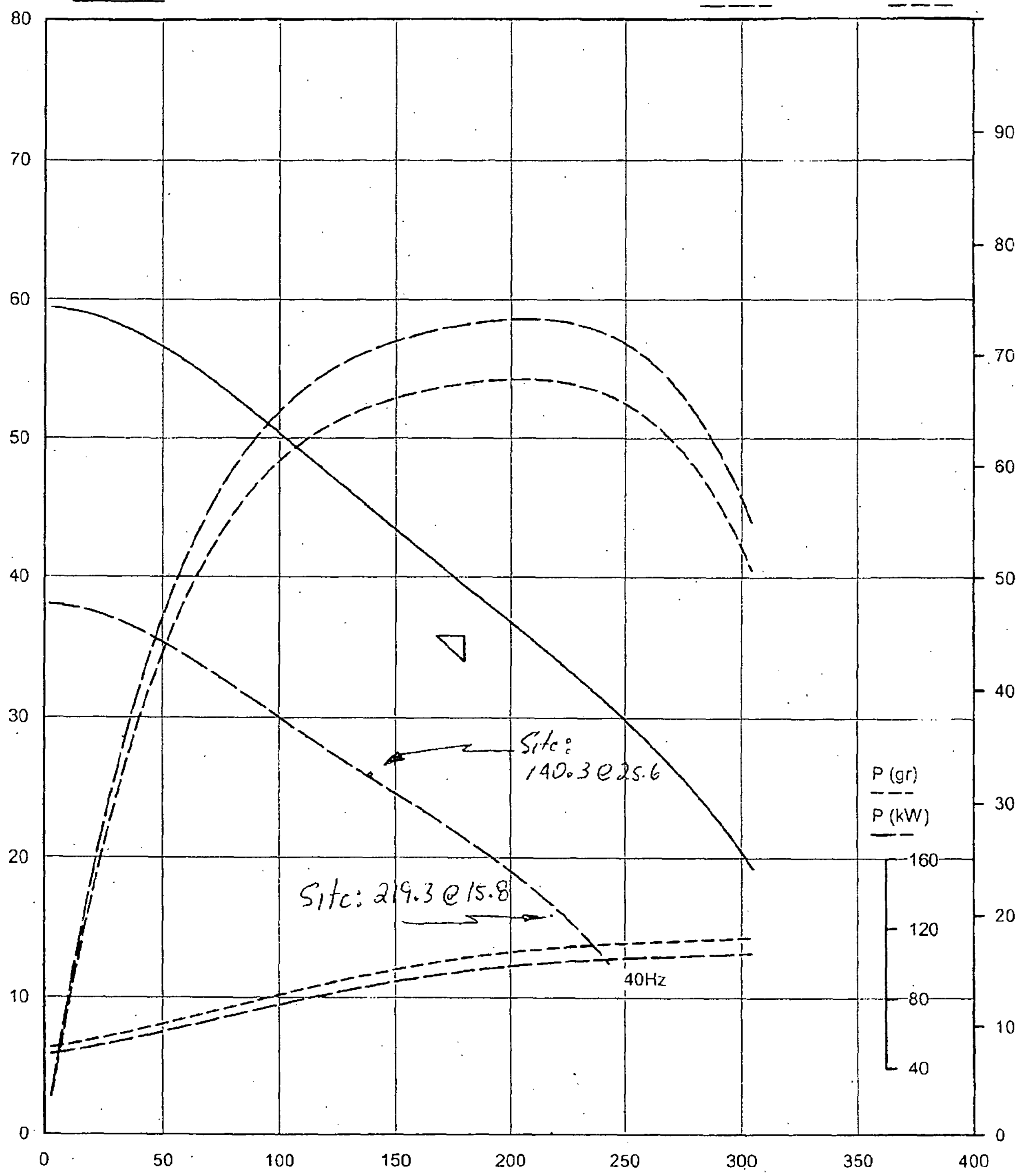
Site Results @ 50Hz – P2.

GRUNDFOS	S2-1154-M3			Curve no:	943365		
	Project Ref P2/182523			Pn	115 kW		
				Nn	1475 1/min		
	REQUIRED DUTY		PUMP DUTY POINT DATA			P (pump)	96.7 kW
	Flow	180 l/sec	Flow	187 l/sec		Eff (pump)	73.0 %
	Head	35.8 m	Head	38.5 m		P (gr)	104 kW
			Energy	155 kWh/1000m3		Eff (gr)	67.6 %



Site Results @ 40Hz - P2.

GRUNDFOS	S2-1154-M3 Project Ref P2/182523		Curve no: 943365 Pn 115 kW Nn 1475 1/min	
	REQUIRED DUTY	**PUMP DUTY POINT DATA**		
	Flow 180 l/sec	Flow 187 l/sec	P (pump) 96.7 kW	Eff (pump) 73.0 %
	Head 35.8 m	Head 38.5 m	P (gr) 104 kW	Eff (gr) 67.6 %
		Energy 155 kWh/1000m3		



SITE RESULTS @ 33Hz — P2

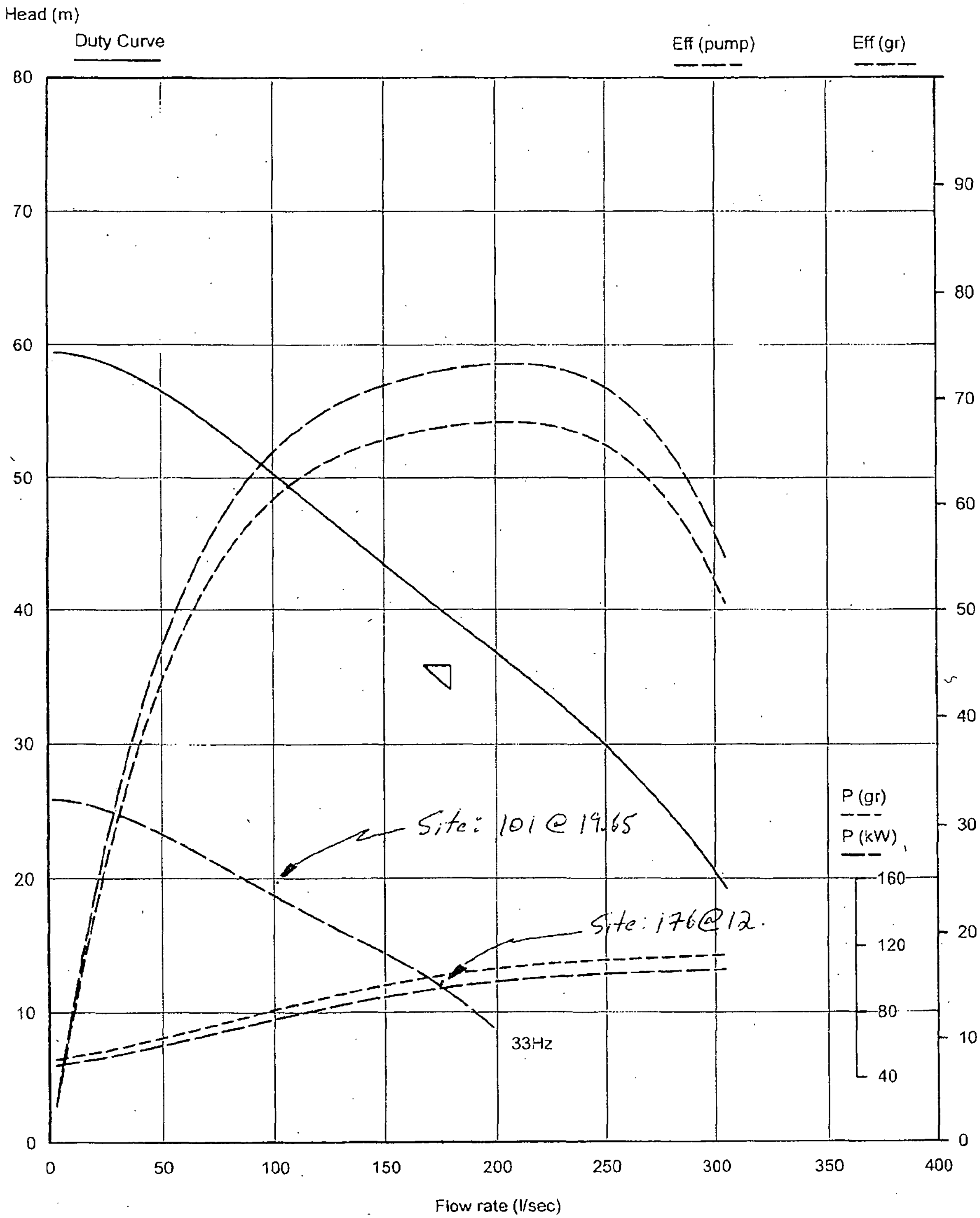
GRUNDFOS

S2-1154-M3

Project Ref P2/182523

Curve no:	943365
Pn	115 kW
Nn	1475 1/min

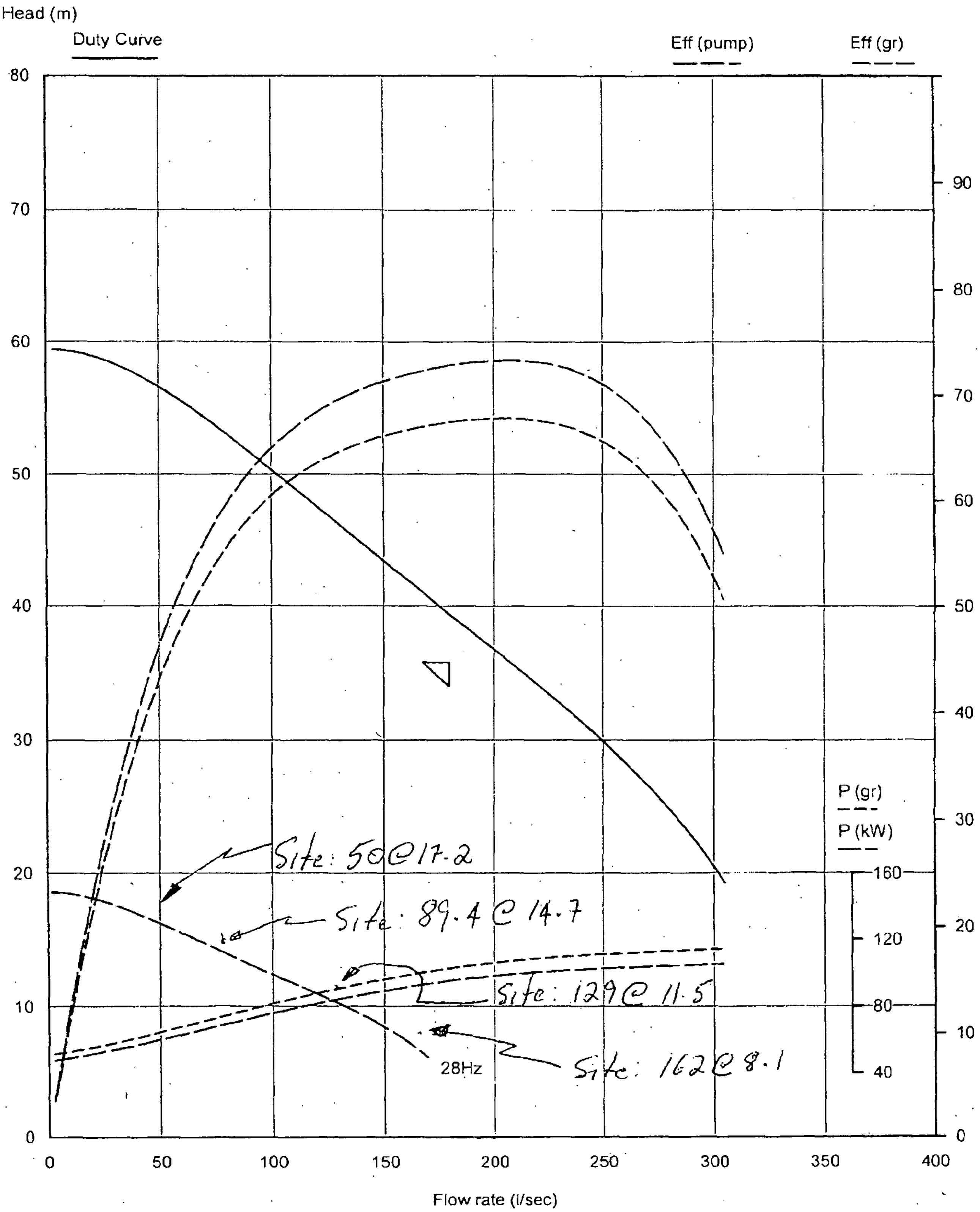
REQUIRED DUTY		PUMP DUTY POINT DATA			
Flow	180 l/sec	Flow	187 l/sec	P (pump)	96.7 kW
Head	35.8 m	Head	38.5 m	Eff (pump)	73.0 %
				P (gr)	104 kW
		Energy	155 kWh/1000m3	Eff (gr)	67.6 %



Site Results @ 28 Hz – P2.

GRUNDFOS	S2-1154-M3 Project Ref P2/182523	Curve no: 943365 Pn 115 kW Nn 1475 1/min

REQUIRED DUTY		PUMP DUTY POINT DATA			
Flow	180 l/sec	Flow	187 l/sec	Eff (pump)	73.0 %
Head	35.8 m	Head	38.5 m	P (gr)	104 kW
		Energy	155 kWh/1000m3	Eff (gr)	67.6 %
				P (pump)	96.7 kW



Date: 0/8/05 Recorded by: W WONG Wet well probe: 0% at ________ mAHD, 100% at ________ mAHD

Time	Station Mode	Generator Running	Pump No 1 (Grundfos serial number: 182521)			Pump No 2 (Grundfos serial number: 182523)			Pump No 3 (Grundfos serial number: 182522)			Pump Delivery (Q)	Pipe Pressure (H)	Wet Well Level	Comments / Pump Performance Test Point
am / pm	Local / Remote	Yes / No	Hz	A	kW	Hz	A	kW	Hz	A	kW	L/sec	m	%	Test point if any (eg. P1 50Hz 4 points test)
1:30 pm	Local	No				50									P2 Reflux switch not actuating, fixed ✓
1:50 pm	Local	No				50							3+8		Pump low pressure, throttling valve too opened
2:00 pm	Local	No	~~[illegible]~~			50	182	115				308	8.4+8	26	P2 50Hz 315L/s
2:06 pm	Local	No				50	183	113				248.2	21.26+8	25	P2 50Hz 250L/s
2:12 pm	Local	No				50	170	103				170	32.9+8	25.5	P2 50Hz 170L/S
2:17 pm	Local	No				50						101	42.3+8	25	P2 50Hz 100L/S
am pm	Local Remote	Yes No													
am pm	Local Remote	Yes No													
am pm	Local Remote	Yes No													
am pm	Local Remote	Yes No													
am pm	Local Remote	Yes No													
am pm	Local Remote	Yes No													

[illegible]
9/08/05

HVAC **SP103 HEROES AVENUE PUMP PERFORMANCE TESTING RECORD** hps

UNCLEAR TEXT

Date: 8/8/05 Recorded by: W WONG Wet well probe: 0% at ______ mAHD, 100% at ______ mAHD

Time	Station Mode	Generator Running	Pump No 1 (Grundfos serial number: 182521)			Pump No 2 (Grundfos serial number: 182523)			Pump No 3 (Grundfos serial number: 182522)			Pump Delivery (Q)	Pipe Pressure (H)	Wet Well Level	Comments / Pump Performance Test Point
am / pm	Local / Remote	Yes / No	Hz	A	kW	Hz	A	kW	Hz	A	kW	L/sec	m	%	Test point if any (eg. P1 50Hz 4 points test)
3:28 pm	Local	No	40	130	55							224	8+8	26	P1 40Hz 220L/S
3:40 pm	Local	No	40	121	50							140.7	18.65+8	26	P1 40Hz 140L/S
3:52 pm	Local	No	~~40~~	~~124~~	~~52~~	40	124	52				140.3	18.6+8	25	P2 40Hz 140L/S
3:59 pm	Local	No	~~40~~			40	131	55				219.3	8.8+8	24	P2 40Hz 220L/S
4:06 pm	Local	No	~~40~~1						40.1	129	55	218	8.8+8	24	P3 40Hz 220L/S
4:12 pm	Local	No							40.1	121	50	140.8	18.8+8	25	P3 40Hz 140L/S
4:19 pm	Local	No							33.1	98	31	175.4	4.7+8	25	P3 33Hz 180L/S
4:29 pm	Local	No							33.1	90	27	102	12.7+8	25	P3 33Hz 100L/S
4:34 pm	Local	No				33.1	94	29				101	12.65+8	26	P2 33Hz 100L/S
4:40 pm	Local	No				33.1	100	32				176	5+8	25	P2 33Hz 180L/S
4:47 pm	Local	No	33.1	99	31							175	5+8	26	P1 33Hz 180L/S
4:53 pm	Local	No	33.1	91	27							100	12.7+8	26	P1 33Hz 100L/S

4:58 P1 Shut Down, 40 & 33Hz Tests Completed * When pumps are off pressure is @ 1.28m head *

9/08/05 Reg McG...

SP103 HEROES AVENUE PUMP PERFORMANCE TESTING RECORD

HVAC hps

... P1 Ramp ... 20 ...

Date: 9/02/05 Recorded by: W WONG Wet well probe: 0% at ________ mAHD, 100% at ________ mAHD

Time	Station Mode	Generator Running	Pump No 1 (Grundfos serial number: 182521)			Pump No 2 (Grundfos serial number: 182523)			Pump No 3 (Grundfos serial number: 182522)			Pump Delivery (Q)	Pipe Pressure (H)	Wet Well Level	Comments / Pump Performance Test Point
am / pm	Local / Remote	Yes / No	Hz	A	kW	Hz	A	kW	Hz	A	kW	L/sec	m	%	Test point if any (eg. P1 50Hz 4 points test)
2:25 pm	Local	No	28	83	20							164	G R.L 2.47+	42	P1 28Hz - 170L/S
2:34 pm	Local	No	28	82	19							135.5	G R.L 5.42+	43	P1 28Hz - 130L/S
2:38 pm	Local	No	28	77	17							85	G R.L 9.6+	43	P1 28Hz - 90L/S
2:43 pm	Local	No	28	68	14							51	G R.L 11.5+	43	P1 28Hz - 50L/S
2:48 pm	Local	No				28	68	14				50	G R.L 11.7+	43	P2 28Hz - 50L/S
2:52 pm	Local	No				28	77	17				84.4	G R.L 9.2+	43	P2 28Hz - 90L/S
2:55 pm	Local	No				28	81	19				129	G R.L 6+	42	P2 28Hz - 130L/S
3:03 pm	Local	No				28	82	19				162	G R.L 2.6+	42	P2 28Hz - 170L/S
3:08 pm	Local	No				~~28~~	~~80~~	~~19~~	28	80	19	160.5	G R.L 2.5+	42.5	P3 28Hz - 170L/S
3:13 pm	Local	No				~~28~~	~~78~~	~~18~~	28	78	18	135	G R.L 5.2	42.5	P3 28Hz - 130L/S
3:17 pm	Local	No				~~28~~	~~74~~	~~16~~	28	74	16	86	G R.L 9.45+	42.5	P3 28Hz - 90L/S
3:22 pm	Local	No				~~28~~	~~67~~	~~14~~	28	67	14	55	G R.L 11.6	42.5	P3 28Hz - 50L/S

Reg McGiven 9/2/05

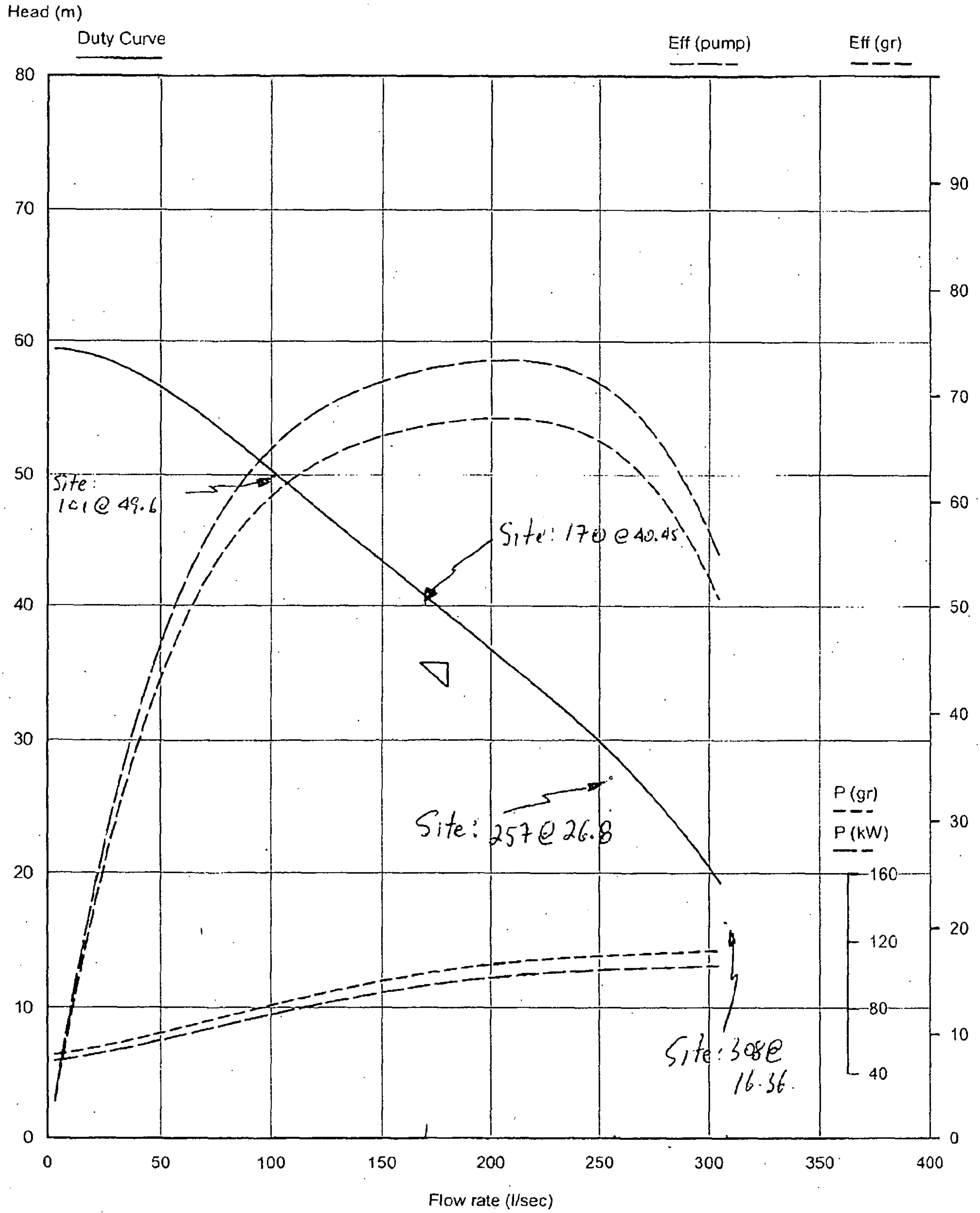
HV...

SP103 HEROES AVENUE PUMP PERFORMANCE TESTING RECORD

hps

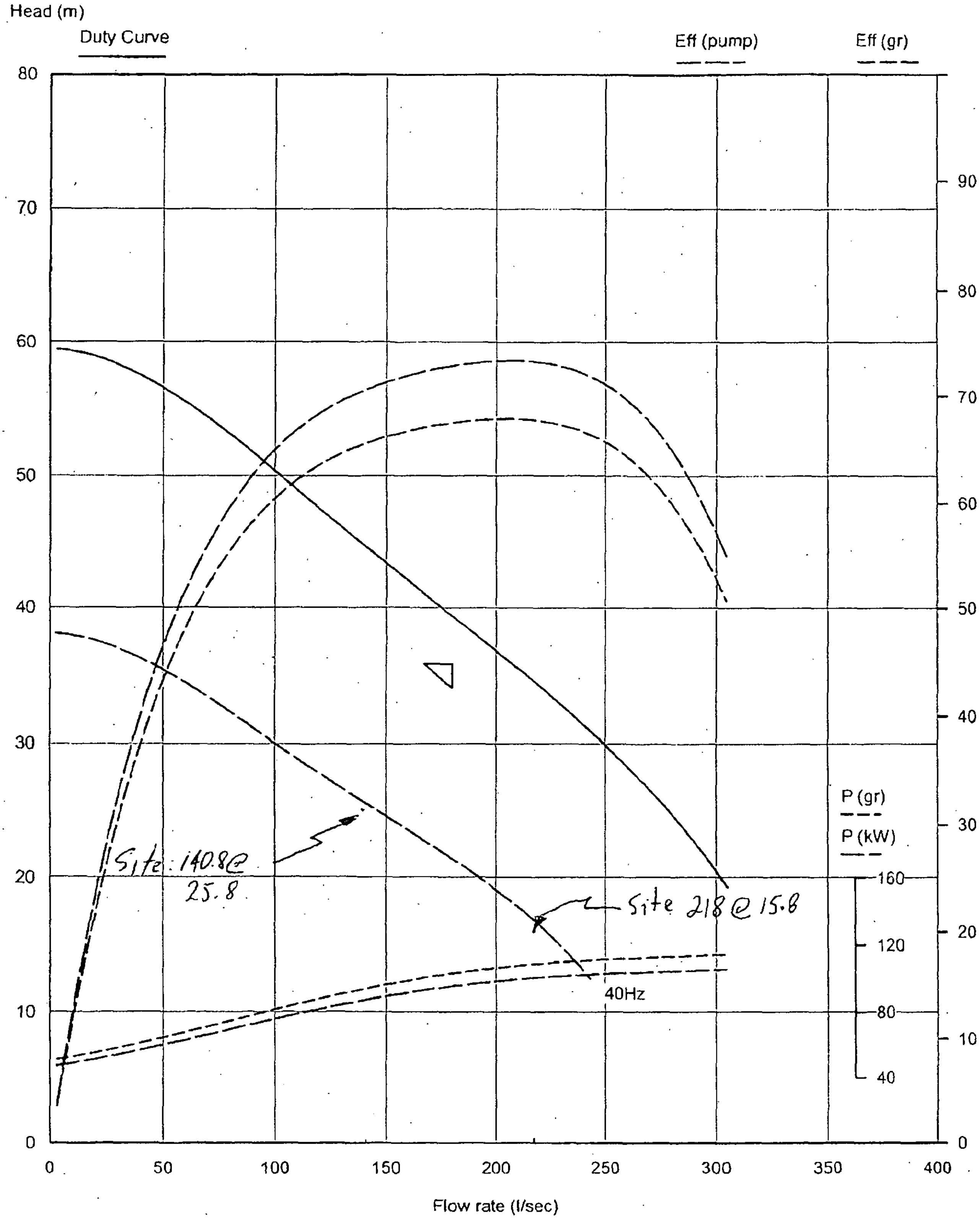
Site Results @ 50 Hz – P3.

GRUNDFOS	S2-1154-M3		Curve no:	943365
	Project Ref P3/182522		Pn	115 kW
			Nn	1475 1/min
	REQUIRED DUTY	PUMP DUTY POINT DATA	P (pump)	96.7 kW
	Flow 180 l/sec	Flow 187 l/sec	Eff (pump)	73.0 %
	Head 35.8 m	Head 38.5 m	P (gr)	104 kW
		Energy 155 kWh/1000m3	Eff (gr)	67.6 %



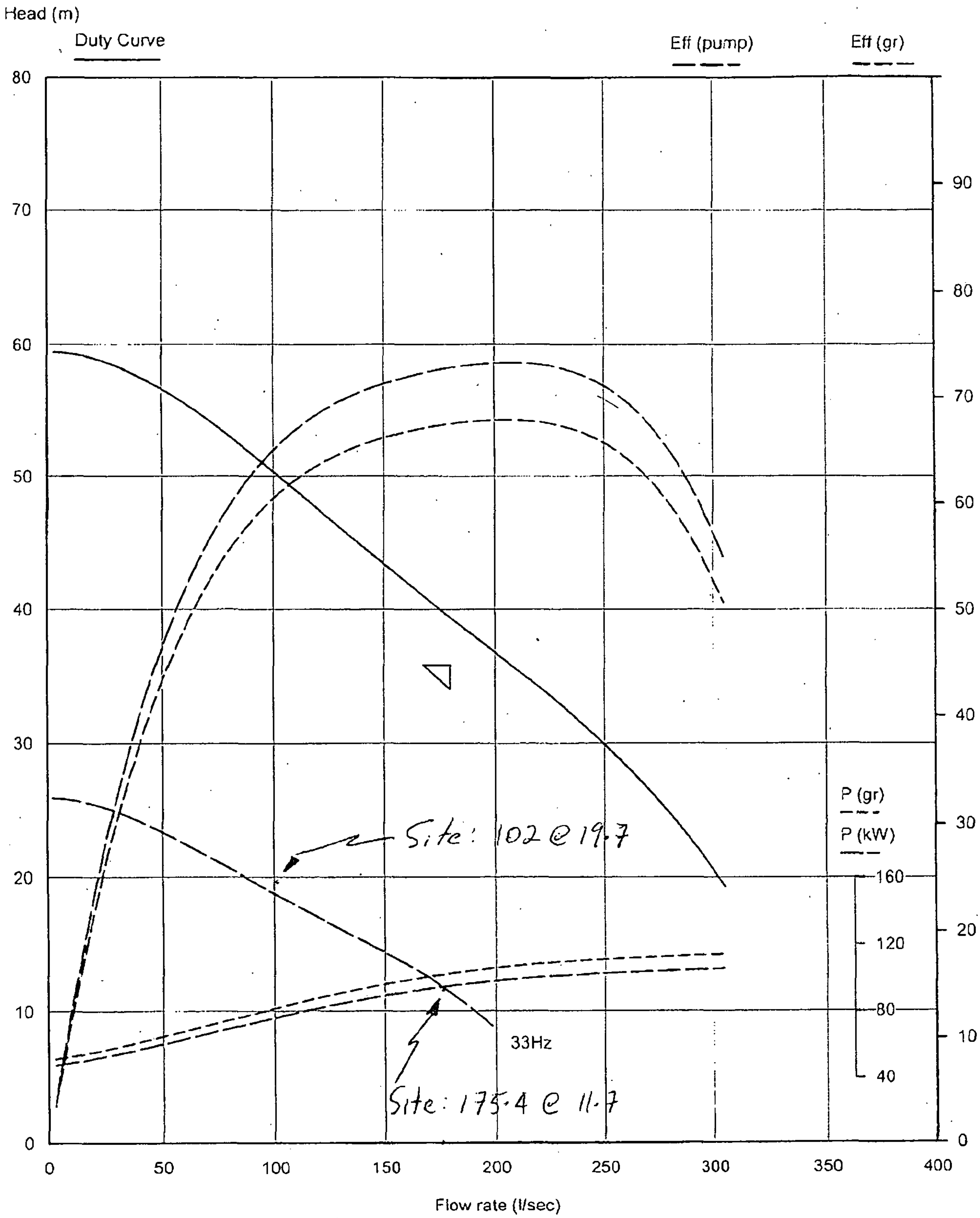
SITE RESULTS @ 40Hz — P3.

GRUNDFOS	S2-1154-M3 Project Ref P3/182522		Curve no: 943365 Pn 115 kW Nn 1475 1/min	
	REQUIRED DUTY	PUMP DUTY POINT DATA		
	Flow 180 l/sec	Flow 187 l/sec	P (pump) 96.7 kW	Eff (pump) 73.0 %
	Head 35.8 m	Head 38.5 m	P (gr) 104 kW	Eff (gr) 67.6 %
		Energy 155 kWh/1000m3		



SITE RESULTS @ 33Hz — P3

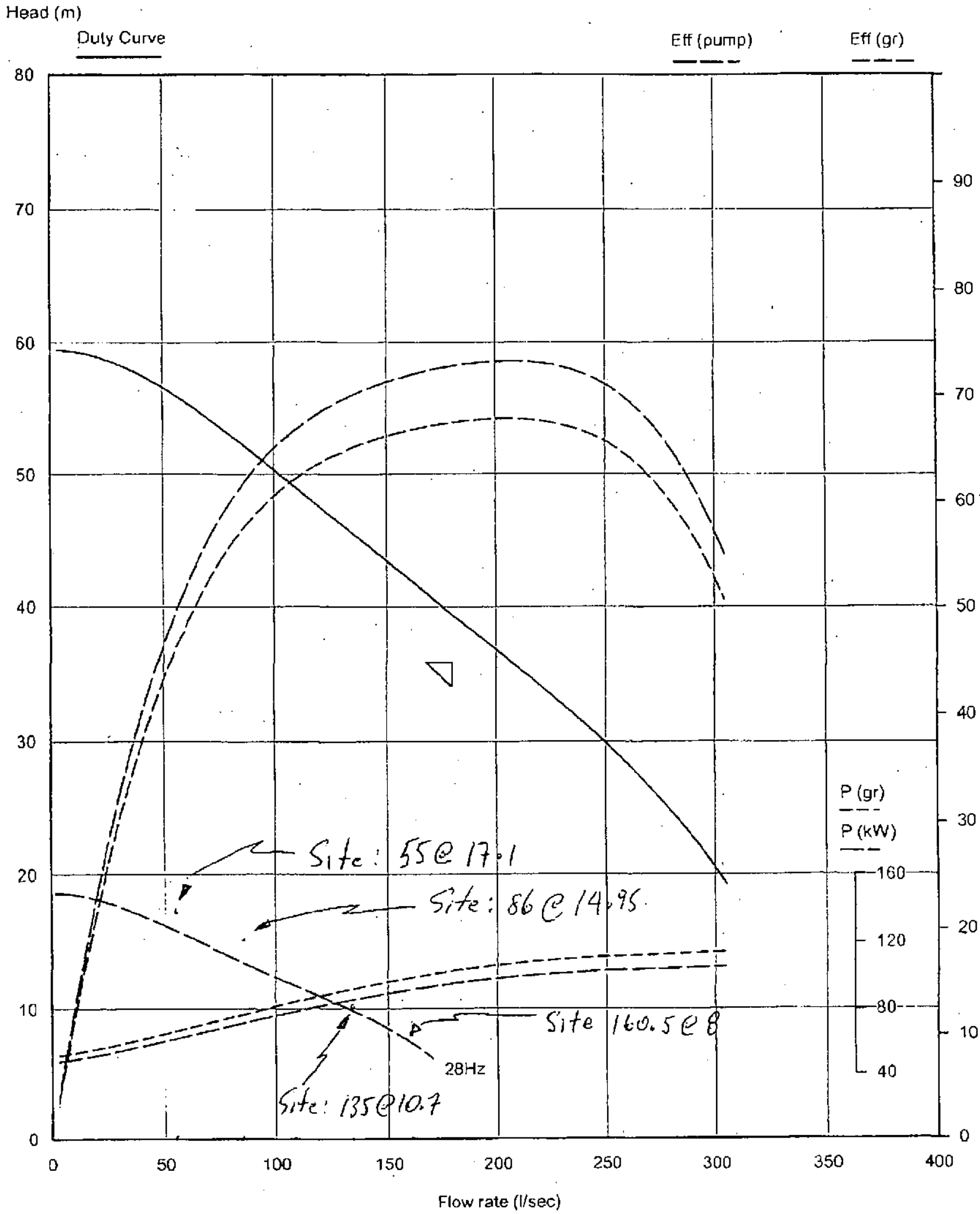
GRUNDFOS	**S2-1154-M3**			Curve no:	943365	
	Project Ref P3/182522			Pn	115 kW	
				Nn	1475 1/min	
	REQUIRED DUTY		**PUMP DUTY POINT DATA**		P (pump)	96.7 kW
	Flow	180 l/sec	Flow	187 l/sec	Eff (pump)	73.0 %
	Head	35.8 m	Head	38.5 m	P (gr)	104 kW
			Energy	155 kWh/1000m3	Eff (gr)	67.6 %



Site Results @ 28Hz - P3.

GRUNDFOS

S2-1154-M3			Curve no:	943365	
Project Ref P3/182522			Pn	115 kW	
			Nn	1475 1/min	
REQUIRED DUTY		PUMP DUTY POINT DATA		P (pump)	96.7 kW
Flow	180 l/sec	Flow	187 l/sec	Eff (pump)	73.0 %
Head	35.8 m	Head	38.5 m	P (gr)	104 kW
		Energy	155 kWh/1000m3	Eff (gr)	67.6 %



Date: 8/8/05 Recorded by: W. WONG Wet well probe: 0% at ________ mAHD, 100% at ________ mAHD

Time	Station Mode	Generator Running	Pump No 1 (Grundfos serial number: 182521)			Pump No 2 (Grundfos serial number: 182523)			Pump No 3 (Grundfos serial number: 182522)			Pump Delivery (Q)	Pipe Pressure (H)	Wet Well Level	Comments / Pump Performance Test Point
am / pm	Local / Remote	Yes / No	Hz	A	kW	Hz	A	kW	Hz	A	kW	L/sec	m	%	Test point if any (eg. P1 50Hz 4 points test)
am 2:25 pm	Local Remote	Yes No												26	P3 50Hz 100L/S
am pm	Local Remote	Yes No													Reflux switch not actuating
am 2:41 pm	Local Remote	Yes No				~~50~~	~~142~~	~~78~~	50	142	78	101.4	42.6+8	26	Fixed reflux ✓
am 2:46 pm	Local Remote	Yes No				~~50~~			50	170	100	170	33.45+8	~~26~~ 25	P3 50Hz 170L/S
am 2:53 pm	Local Remote	Yes No							50	183	111	257	19.8+8	24	P3 50Hz 250L/S
am 2:59 pm	Local Remote	Yes No							50	186	114	308	9.2+8	23-24	P3 50Hz 315L/S
am 3:04 pm	Local Remote	Yes No													P3 off, 50Hz tests done
am pm	Local Remote	Yes No													
am pm	Local Remote	Yes No													
am pm	Local Remote	Yes No													
am pm	Local Remote	Yes No													
am pm	Local Remote	Yes No													

Reg McG
9/03/06

HVAC

SP103 HEROES AVENUE PUMP PERFORMANCE TESTING RECORD

hps

Date: 8/6/05 Recorded by: W WONG Wet well probe: 0% at ________ mAHD, 100% at ________ mAHD

Time	Station Mode	Generator Running	Pump No 1 (Grundfos serial number: 182521)			Pump No 2 (Grundfos serial number: 182523)			Pump No 3 (Grundfos serial number: 182522)			Pump Delivery (Q)	Pipe Pressure (H)	Wet Well Level	Comments / Pump Performance Test Point
am / pm	Local / Remote	Yes / No	Hz	A	kW	Hz	A	kW	Hz	A	kW	L/sec	m	%	Test point if any (eg. P1 50Hz 4 points test)
3:28 pm	Local	No	40	130	55							224	8+8	26	P1 40Hz 220L/S
3:40 pm	Local	No	40	121	50							140.7	18.65+8	26	P1 40Hz 140L/S
3:52 pm	Local	No	~~40~~	~~124~~	~~52~~	40	124	52				140.3	18.6+8	25	P2 40Hz 140L/S
3:59 pm	Local	No	~~40~~			40	131	55				219.3	8.8+8	24	P2 40Hz 220L/S
4:06 pm	Local	No	~~40~~						40.1	129	55	218	8.8+8	24	P3 40Hz 220L/S
4:12 pm	Local	No							40.1	121	50	140.8	18.8+8	25	P3 40Hz 140L/S
4:19 pm	Local	No							33.1	98	31	175.4	4.7+8	25	P3 33Hz 180L/S
4:29 pm	Local	No							33.1	90	27	102	12.7+8	25	P3 33Hz 100L/S
4:34 pm	Local	No				33.1	94	29				101	12.65+8	26	P2 33Hz 100L/S
4:40 pm	Local	No				33.1	100	32				176	5+8	25	P2 33Hz 180L/S
4:47 pm	Local	No	33.1	99	31							175	5+8	26	P1 33Hz 180L/S
4:53 pm	Local	No	33.1	91	27							100	12.7+8	26	P1 33Hz 100L/S

9/06/05 R. McG[illegible]

4:58 P1 Shut Down, 40 & 33HZ Tests Completed * When pumps are off, pressure is @ 1.27m head *

SP103 HEROES AVENUE PUMP PERFORMANCE TESTING RECORD

HVAC hps

[illegible] Ramp Up 20s P1 Ramp D[illegible] [illegible] Stop 2[illegible]

UNCLEAR TEXT

Date: [illegible] Recorded by: [illegible] wet well probe: 0% at ________ mAHD, 100% at ________ mAHD

Time	Station Mode	Generator Running	Pump No 1 (Grundfos serial number: 182521)			Pump No 2 (Grundfos serial number: 182523)			Pump No 3 (Grundfos serial number: 182522)			Pump Delivery (Q)	Pipe Pressure (H)	Wet Well Level	Comments / Pump Performance Test Point
am / pm	Local / Remote	Yes / No	Hz	A	kW	Hz	A	kW	Hz	A	kW	L/sec	m	%	Test point if any (eg. P1 50Hz 4 points test)
2:25 pm	Local	No	25	33	20							164	G RL 2.47+	42	P1 25Hz - 170 L/S
2:34 pm	Local	No	25	32	19							135.5	G RL 5.42+	43	P1 25Hz - 130 L/S
2:3? pm	Local	No	25	47	17							85	G RL 9.6+	43	P1 25Hz 90 L/S
2:43 pm	Local	No	25	63	14							51	G RL 11.5+	43	P1 25Hz - 50 L/S
2:43 pm	Local	No				25	63	14				50	G RL 11.7	43	P2 25Hz - 50 L/S
2:52 pm	Local	No				25	47	17				89.4	G RL 9.2	43	P2 25Hz 90 L/S
2:58 pm	Local	No				25	31	19				129	G RL 6+	42	P2 25Hz 130 L/S
3:03 pm	Local	No				25	32	19				162	G RL 2.6+	42	P2 25Hz - 170 L/S
3:05 pm	Local	No				~~25~~	~~30~~	~~19~~	25	30	19	160	G RL 2.5+	42.5	P3 25Hz - 170 L/S
3:13 pm	Local	No				~~25~~	~~45~~	~~19~~	25	45	19	135	G RL 5.2	42.5	P3 25Hz - 130 L/S
3:17 pm	Local	No				~~25~~	~~74~~	~~16~~	25	74	16	86	G RL 9.45	42.5	P3 25Hz - 90 L/S
3:22 pm	Local	No				~~25~~	~~64~~	~~14~~	25	64	14	55	G RL 11.6	42.5	P3 25Hz - 50 L/S

[illegible signature] 11/12/[illegible]

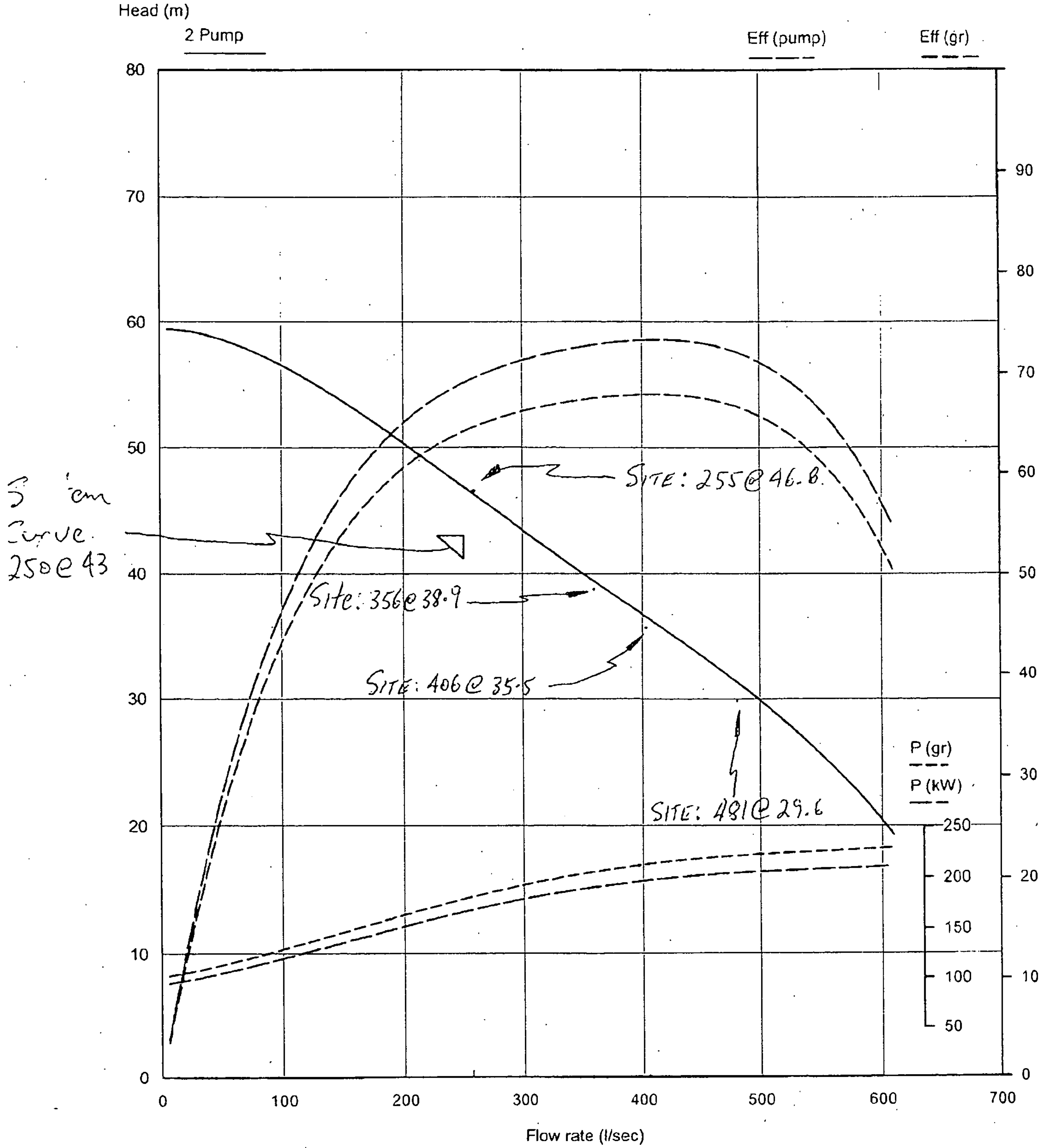
HVAC

SP103 HEROES AVENUE PUMP PERFORMANCE TESTING RECORD

hps

SITE RESULTS @ 50Hz – P1 & P2. Combined.

GRUNDFOS	S2-1154-M3 Project Ref 2 PUMPS		Curve no: 943365 Pn 115 kW Nn 1475 1/min
	REQUIRED DUTY Flow 250 l/sec Head 43 m	**PUMP DUTY POINT DATA** Flow 130 l/sec Head 46.4 m Energy 195 kWh/1000m3	P (pump) 85.1 kW Eff (pump) 69.6 % P (gr) 91.6 kW Eff (gr) 64.7 %



Date: 0', 08/05 Recorded by: W. WONG Wet well probe: 0% at ______ mAHD, 100% at ______ mAHD

Time	Station Mode	Generator Running	Pump No 1 (Grundfos serial number: 182521)			Pump No 2 (Grundfos serial number: 182523)			Pump No 3 (Grundfos serial number: 182522)			Pump Delivery (Q)	Pipe Pressure (H)	Wet Well Level	Comments / Pump Performance Test Point
am / pm	Local / Remote	Yes / No	Hz	A	kW	Hz	A	kW	Hz	A	kW	L/sec	m	%	Test point if any (eg. P1 50Hz 4 points test)
12:05 am / pm	Local / Remote	Yes / No											1.80		Prior to test
12:10 am / pm	Local / Remote	Yes / No	50	181	100	50	181	100				481	G 23+ R.L.	29	2 Pumps @ 50 Hz, 480 L/s
12:21 am / pm	Local / Remote	Yes / No	50	176	105	50	178	107				~~[illegible]~~ 406	G 28.9+ R.L.	29	2 Pumps @ 50Hz, 400 L/s
12:29 am / pm	Local / Remote	Yes / No	50	171	101	50	171	101				356	G 32.3+ R.L.	29	2 Pumps @ 50Hz, 350 L/s
12:35 am / pm	Local / Remote	Yes / No	50	154	90	50	154	90				255	G 40.2+ R.L.	30	2 Pumps @ 50Hz, 250 L/s
12:38 am / pm	Local / Remote	Yes / No											G 1.9+ ~~R.L.~~		P1/P2 STOP
~~12:44~~ am / ~~pm~~	Local / ~~Remote~~	Yes / ~~No~~	~~28~~												~~P1 28 Hz 170 L/s~~
am / pm	Local / Remote	Yes / No													
am / pm	Local / Remote	Yes / No													
am / pm	Local / Remote	Yes / No													
am / pm	Local / Remote	Yes / No													
1:15 to 1:30 am / pm	Local / Remote	Yes / No	E-Stops on P1/2/3 actuated during each pump running at 50Hz												

Rec. McG... 9/08/05

VSDs tripped on Alarm 7 (DC Link Overvoltage) - 808V recorded

HVAC

SP103 HEROES AVENUE PUMP PERFORMANCE TESTING RECORD

hps

Confirmation

12-AUG-2005 16:01 FRI

Fax Number : +61 7 38761499
Name : HVAC QLD HEROES AVE

Name/Number	:	BRISBANE WATER / 034030205
Page	:	24
Start Time	:	12-AUG-2005 15:55 FRI
Elapsed Time	:	05'20"
Mode	:	Fine ECM
Status	:	[O.K]

Facsimile Message

To :	BRISBANE WATER		
Attention :	M. HERITAGE/R. MCGIRR	**Date :**	12/08/05
From :	GRAHAM JAMES	**Ref :**	BRI050812_pump test curves.doc
		Fax No :	
Subject :	**PUMP TEST CURVES FOR HEROES AVENUE**		

Mike/ Reg,

Please find attached the pump test curves for the tests carried out on the 8th and 9th August 2005 at Heroes Avenue. These are a complete set based on the signed off test sheets with the correct head values for all readings.

Please disregard previous curves as they were not based on the signed off values.

I hope these will satisfy your requirements. If there are any issues with respect to these please advise me at your earliest opportunity and I will address these immediately.

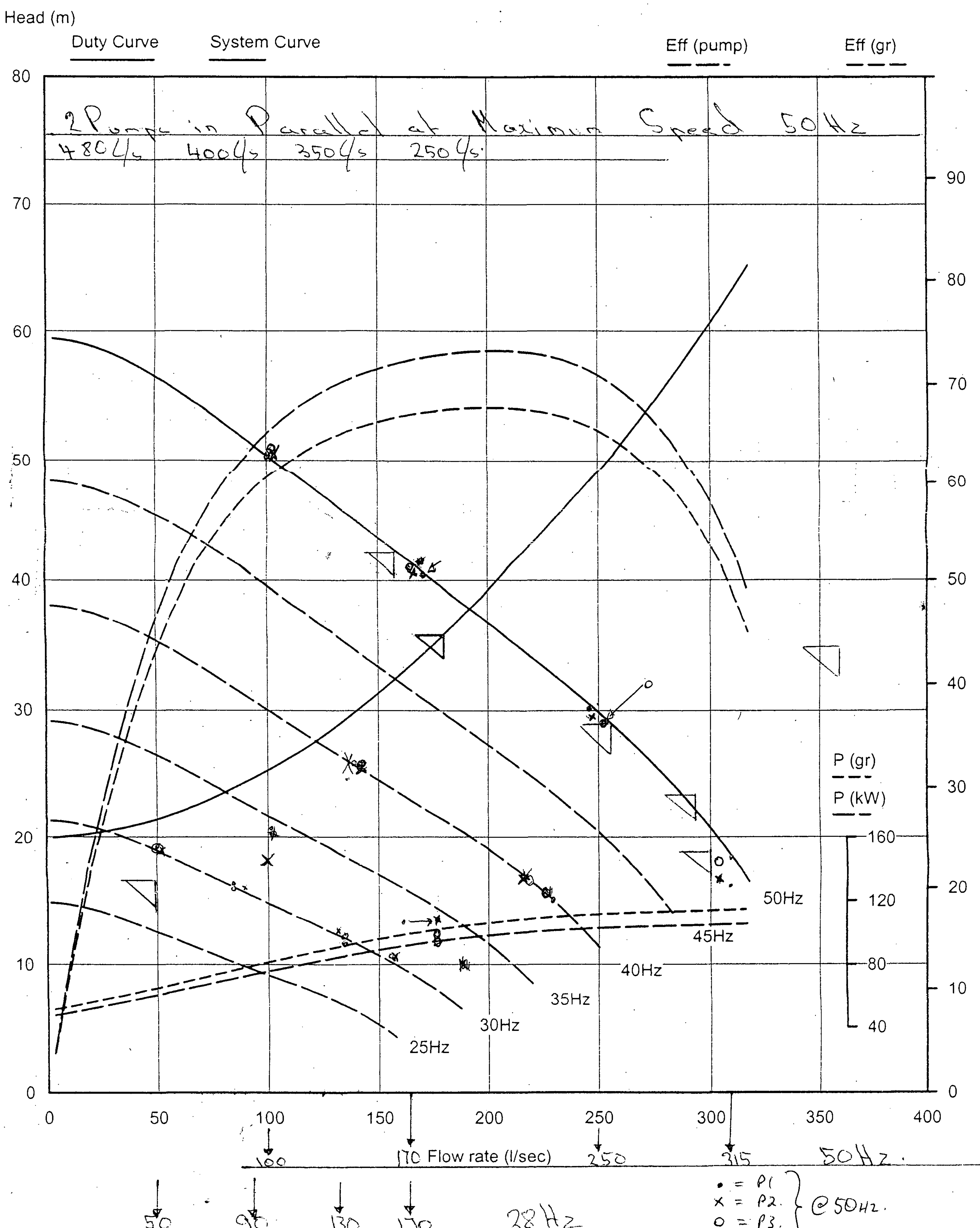
Regards

Graham James
Project Manager

GRUNDFOS

S2-1[illegible] 4-M3		Curve no:	943365	
Project Ref DEFAULT		Pn	115 kW	
		Nn	1475 1/min	

REQUIRED DUTY		PUMP DUTY POINT DATA			
Flow	180 l/sec	Flow	192 l/sec	P (pump)	97.3 kW
Head	35.8 m	Head	37.8 m	Eff (pump)	73.1 %
		Energy	152 kWh/1000m3	P (gr)	105 kW
				Eff (gr)	67.7 %



BRISBANE CITY COUNCIL

ATTACHMENTS - PART A

Contract No. BW.30079-02/03

SCHEDULE C3 HEROES AVENUE PUMPS

GUARANTEES: The Contractor agrees to guarantee the following information and figures:

Item No.	Description	Requirement	Offer ("X" Indicates Compliance)
C3.1	**Required Performance**		Head / QTY
C3.1.1	Testing	AS2417-2001 Grade 1	ISO 9906 - Grade 2
C3.1.2	Delivery (l/sec)	360	180 L/sec each +5%
C3.1.3	Head (m)	~~43.2235.80~~	35.8
C3.1.4	Max Speed of Pump	50Hz	50 Hz
C3.1.5	Min Submergence Level	Refer Functional Specifications and drawings	N/A Dry Well
C3.1.6	Hazard Rating of Installation	Class 1 Zone 0 AS3000-2000	Zone 1.
C3.1.7	Diameter of Sphere Passed	Refer Standard Specification	100 mm
C3.1.8	Pump Flange Drilling	Full Face to AS4087	Din
C3.2	**Materials**		
C3.2.1	Baseplate or stool	Refer Standard Spec	Steel
C3.2.2	Casing	Refer Standard Spec	GRS 250
C3.2.3	Sealing Rings	Refer Standard Spec	N/A Smart Trim
C3.2.4	Shaft	Refer Standard Spec	DIN 1.7200
C3.2.5	Impeller	Refer Standard Spec	GRP 500
C3.2.6	Shaft Sleeve	Refer Standard Spec	N/A
C3.2.7	Mechanical Seal	Refer Standard Spec	Carbon/Sic & Sic/Sic
C3.2.8	Bolts, Studs and Nuts	Refer Standard Spec	St St.
C3.3	**General Details**		
C3.3.1	Name of Pump Manufacturer	Grundfos Pumps	
C3.3.2	Place of Manufacture of Pump	Finland	
C3.3.3	Type of pump offered	Dry Well - Sewerage	
C3.3.4	Appropriate mass of each pumping unit (including motor, cables, and lifting chain where applicable)	Pump & Motor 1400kg	
C3.4	**Performance**		
C3.4.1	Speed of Pump	1475	

Name of Tenderer: Grundfos Pumps P.L

Signature of Tenderer: [signature] Date: 2/7/04

Name of Witness: Paul Sloan [signature] Signature of Witness:

BRISBANE CITY COUNCIL

Contract No. BW.30079-02/03 **ATTACHMENTS - PART A**

Item No.	Description	Requirement	Offer ("X" Indicates Compliance)
C3.4.2	Maximum kW required at coupling (including flood head conditions as per system curve)	105	
C3.4.3	KW of motor offered	115	
C3.4.4	Guaranteed maximum head at zero quantity (m of water)	60	
C3.4.5	Maximum Head developed by pump	60	
C3.4.6	Maximum kW demand of motor	105	
C3.4.7	Sound Power Level of Pump (dB(A))	See below	
C3.4.8	Sound Power Level of Motor (dB(A))	See below	
C3.4.9	Sound Power Level of Pump Motor Combination (dB(A))	< 70 dba	
C3.4.10	Minimum NPSHR at mean head conditions (m)	6.0m	

Item No.	Description	Head (m)	Flow (l/sec)	Pump Efficiency (%)	Overall Efficiency (%)	KWh/kL	NPSH Required
C3.5	**Guaranteed Performance** (Refer attached Operating Envelope)						
C3.5.1	2 Pumps in Parallel at Maximum Speed						
	(a) Wet Weather	37.5	382	73.0	67.5	0.15	6.0
	(b) Min Head	33.0	455	73.0	67.5	0.13	6.5
	(c) Flood Condition	32.0	477	71.0	66.0	0.13	7.0
	(d) Bypass	44.5	290	71.0	66.0	0.165	6.0
C3.5.2	Single Pump at Maximum Speed						
	(a) Wet Weather	29.5	255	70.0	65.0	0.12	7.5
	(b) Min Head	22.5	290	59.0	54.5	0.11	8.5
	(c) Flood Condition	19.5	300	58.0	53.0	0.10	9.0
C3.5.3	Single Pump at Minimum Speed						
	(a) Min Head 28Hz	16.03	50	—	—	—	—

Item No.	Description	Requirement
C3.6	**Shaft and Impeller**	
C3.6.1	Diameter of Shaft	65 @ Impeller, 92 max
C3.6.2	Make Type and Size of Bearings	SKF, BALL, upper - 6313C3, Lower 7316B6 x 2
C3.6.3	Diameter of impeller offered	428/414 Tapered

Name of Tenderer: Grundfos Pumps P. L

Signature of Tenderer: [signature] Date: 2/7/04

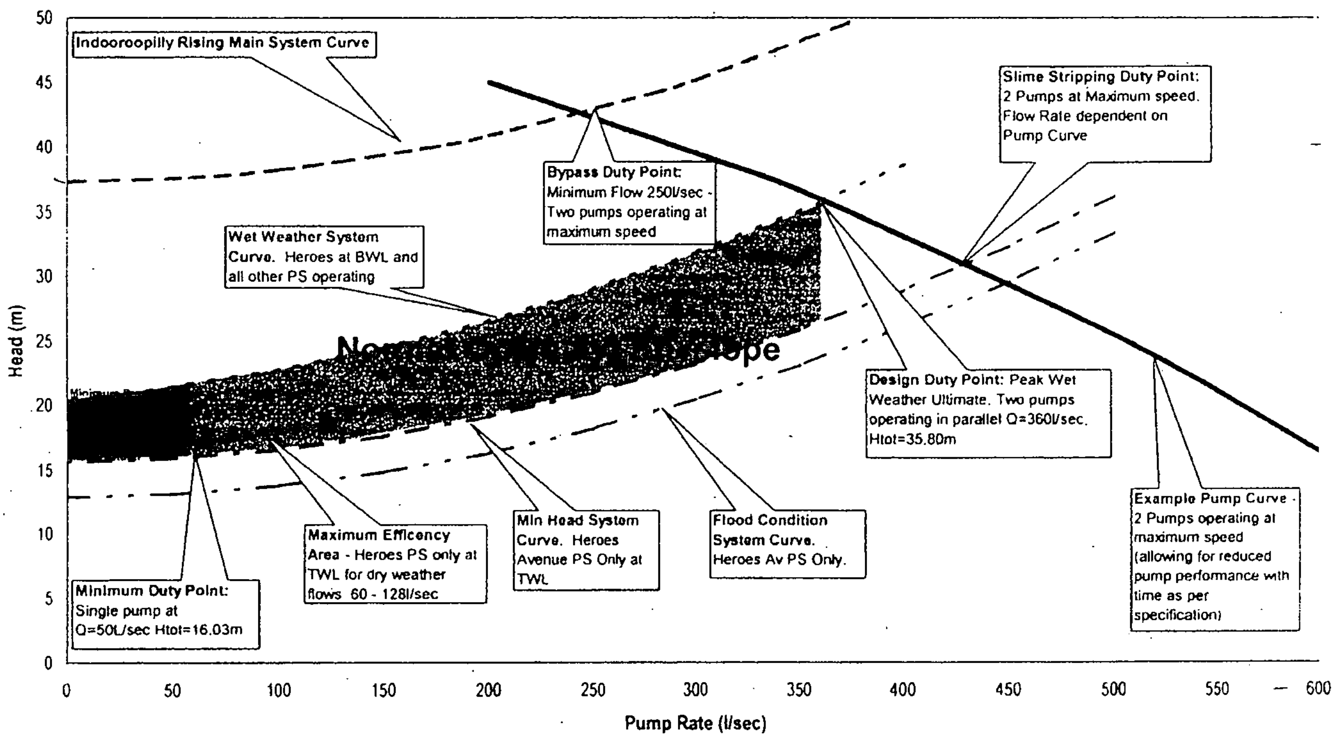
Name of Witness: [illegible] Signature of Witness: [signature]

BRISBANE CITY COUNCIL

ATTACHMENTS - PART A **Contract No. BW.30079-02/03**

Item No.	Description	Requirement	Offer ("X" Indicates Compliance)
C3.6.4	Maximum diameter of impeller	428/414	
C3.6.5	Width of Impeller between shrouds	113	
C3.6.6	Thickness of Impeller Shrouds	10	
C3.6.7	Minimum diameter of impeller eye	220	
C3.6.8	Number of vanes in impeller	TWO	
C3.6.9	Method of fixing impeller to shaft	Nut & Key on Tapered Shaft	
C3.6.10	Method of access to remove blockages	Suction Bend - Inspection Port.	
C3.7	**Other Details**		
C3.7.1	Dia of Suction Branch	250 x 300	
C3.7.2	Diameter of Discharge Branch	200	
C3.7.3	Direction of Rotation (from drive end)	Clockwise	

Heroes Avenue - Operating Envelope

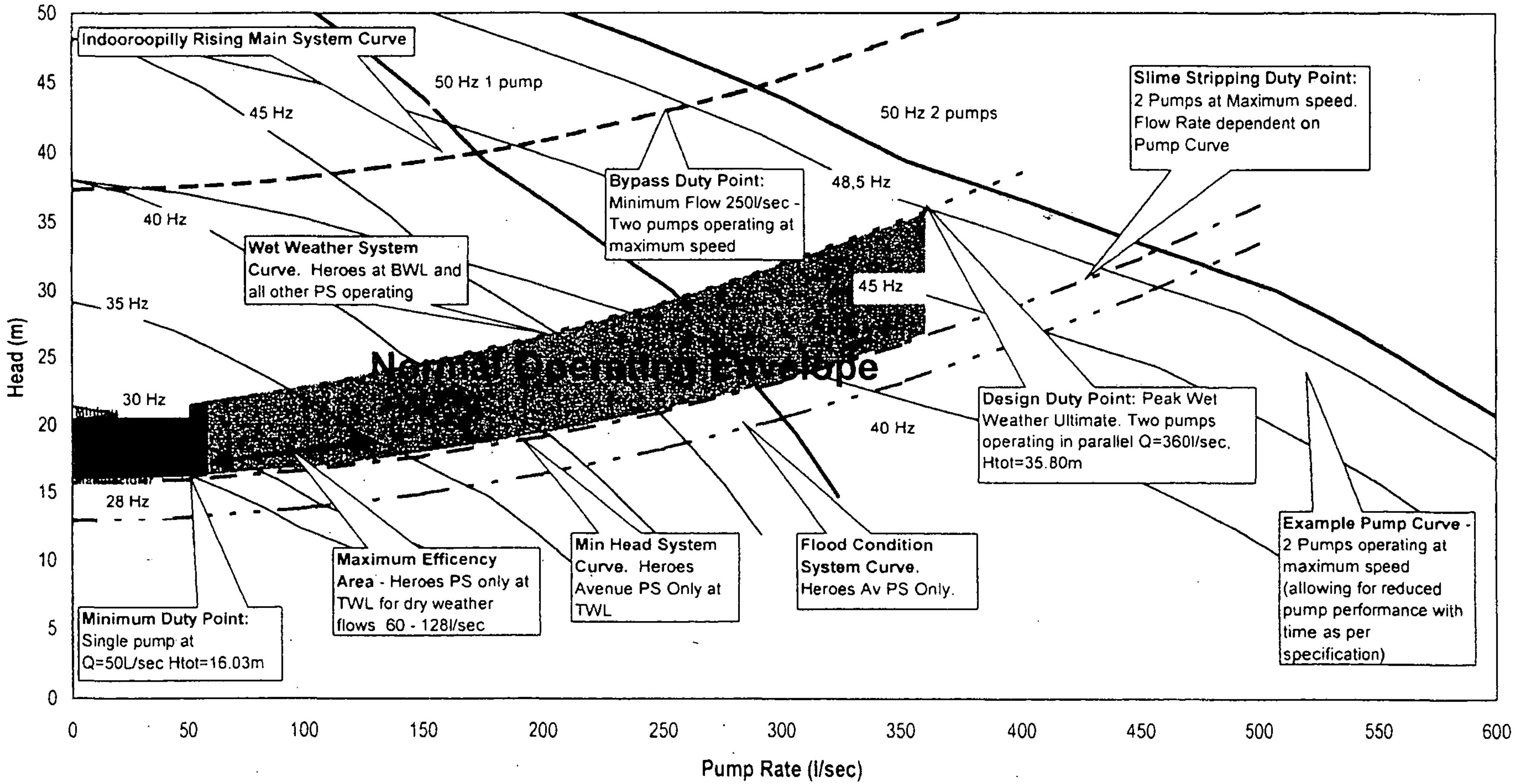


Name of Tenderer: Grundfos Pumps P L

Signature of Tenderer: [signature] Date: 24/7/09

Name of Witness: Paul Stha... Signature of Witness: [signature]

Heroes Avenue - Operating Envelope
S2 1154 M3 Curve D-943365



FILE S:\Work\020311CW\s-sheets\Heroes Avenue-Patrick Lane System Curves 040618:Heroes Op Env | Printed on 1/07/2004 at 6:17 PM | Page 1 of 1

Oy Grundfos Environment Finland Ab
ADDRESS: Kaivokselantie 3-5, FIN-01610 VANTAA TEL: +358-9-561420

GRUNDFOS

Pump	**S21154M3B513ZB93**
SAP	96553681
Duty	**180 l/s x 39 m**

Test Report for Pump

ISO 9906 Grade 2

Verification of duty point

GRUNDFOS

tomer :

Order No. :

Date of test : 15.10.2004 17:13

Tester : V7186186 **Operator :** JSA

Serial No. : 965536810182521 **SAP-Code :** 96553681

Pump type :

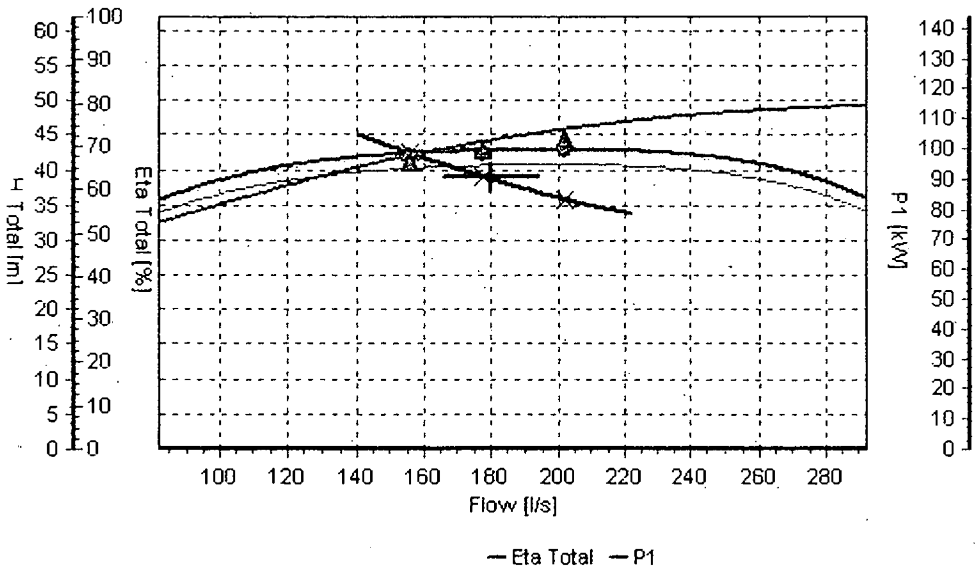
tomer request :

	Flow (l/s)	Head (m)
Duty point	**180.00**	**39.00**

Grundfos Environment Finland Ab
Kaivokselantie 3-5, Vantaa
P.O. Box 1036
Fin-00101 Helsinki
Phone: +358 9 561 420
Fax: +358 9 563 3989

Test results for serial no. : 965536810182521

	Flow (l/s)	Head (m)	U1 (V)	U2 (V)	U3 (V)	I avg. (A)	P1 (kW)	Eta (%)
Point 1	155.66	42.36	413	413	413	165.3	95.1	67.7
Point 2	177.66	38.94	413	413	413	171.7	99.5	68.2
Point 3	202.07	35.81	413	413	413	177.8	103.6	68.9



Test Report for Pump

Manual test procedure

GRUNDFOS

Or('lo.:

Date of test : 15.10.2004 17:59

Operaωr : JSA

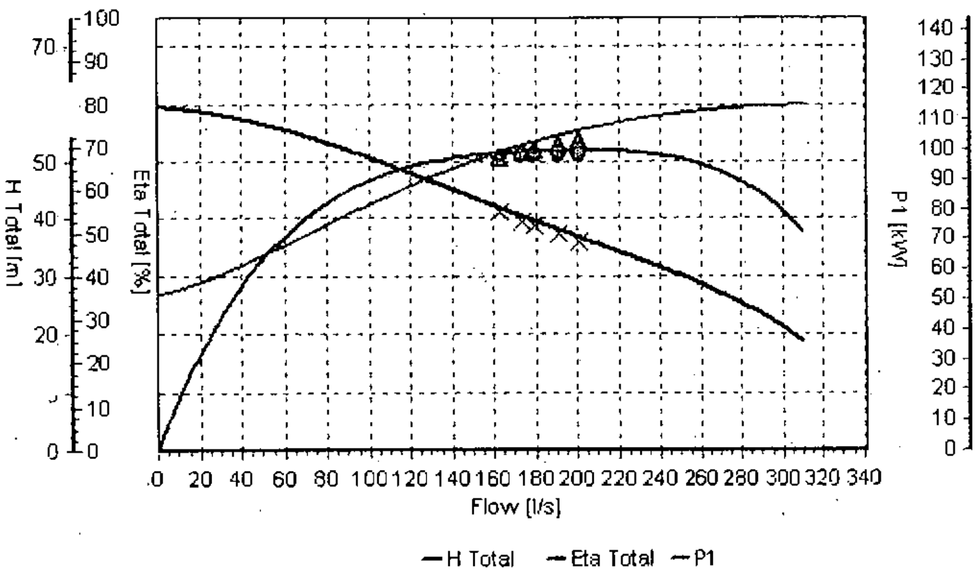
Tester : V7186186

Serial no. : 96553681B182521

SAP-code : 96553681

Pump Type :

	Flow (l/s)	Head (m)	U1 (V)	U2 (V)	U3 (V)	I avg. (A)	P1 (kW)	Eta (%)
Point 1	162.26	41.26	413	413	413	167.7	97.3	67.7
Point 2	173.69	39.46	413	413	413	171.1	99.2	67.9
Point 3	179.45	38.67	413	413	413	172.4	100.3	68.1
Point 4	190.57	37.39	413	413	413	175.5	102.4	67.9
Point 5	200.57	35.86	413	413	413	176.8	103.3	68.2



Grundfos Environment Finland Ab
Kaivokselantie 3-5, Vantaa
P.O. Box 1036
Fin-00101 Helsinki
Phone: +358 9 561 420
Fax: +358 9 563 3989

Test Report for Pump

ISO 9906 Grade 2

Verification of duty point

GRUNDFOS

stomer :

Order No. :

Date of test : 15.10.2004 19:55

Tester : V7186186 **Operator :** JSA

Serial No. : 96553681A182522 **SAP-Code :** 96553681

Pump type :

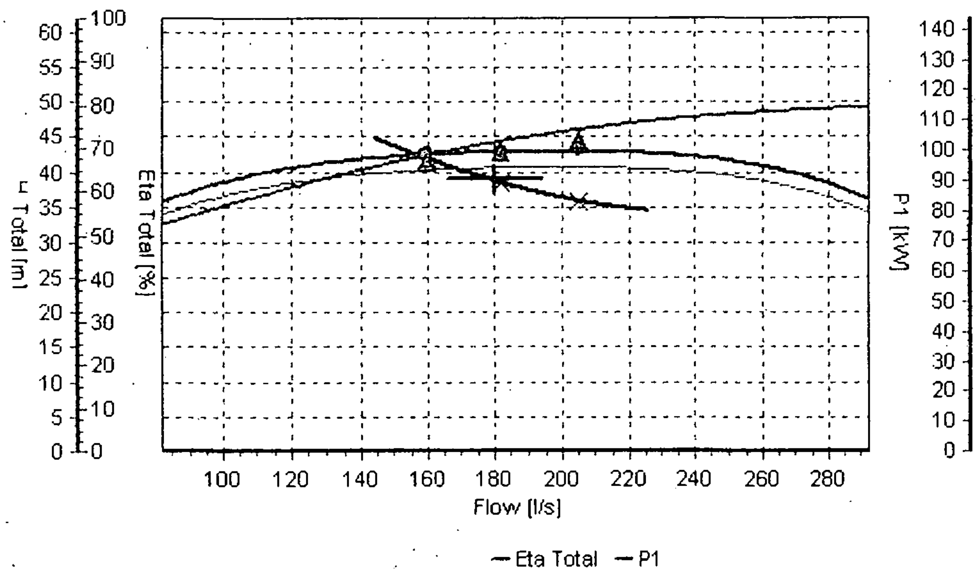
~ustomer request :

	Flow (l/s)	Head (m)
Duty point	**180.00**	**39.00**

Grundfos Environment Finland Ab
vokselantie 3-5, Vantaa
P.O. Box 1036
Fin-00101 Helsinki
Phone: +358 9 561 420
Fax: +358 9 563 3989

Test results for serial no. : 96553681A182522

	Flow (l/s)	Head (m)	U1 (V)	U2 (V)	U3 (V)	I avg. (A)	P1 (kW)	Eta (%)
Point 1	159.55	41.89	413	413	413	165.2	95.7	68.5
Point 2	181.43	38.51	413	413	413	170.4	99.6	68.8
Point 3	205.30	35.86	413	413	413	175.9	103.5	69.8



Test Report for Pump

Manual test procedure

GRUNDFOS

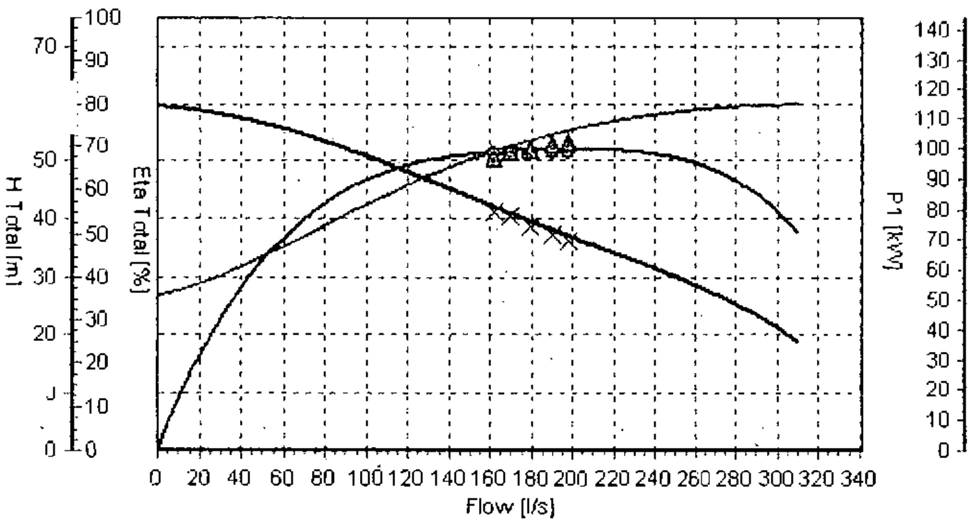
O No.:
Date of test : 15.10.2004 20:24

Operator : JSA
Tester : V7186186

Serial no. : 96553681B182522
SAP-code : 96553681

Pump Type :

	Flow (l/s)	Head (m)	U1 (V)	U2 (V)	U3 (V)	I avg. (A)	P1 (kW)	Eta (%)
Point 1	161.99	41.16	413	413	413	166.6	96.4	68.1
Point 2	169.35	40.65	413	413	413	169.3	98.7	68.1
Point 3	179.05	38.59	413	413	413	170.4	99.5	68.1
Point 4	190.30	37.38	413	413	413	173.7	101.7	68.5
Point 5	198.07	36.19	412	413	413	174.5	102.1	68.7



Grundfos Environment Finland Ab
Kaivokselantie 3-5, Vantaa
P.O. Box 1036
Fin-00101 Helsinki
Phone: +358 9 561 420
Fax: +358 9 563 3989

Test Report for Pump

ISO 9906 Grade 2

Verification of duty point

GRUNDFOS

stomer :

Order No. :

Date of test : 16.10.2004 8:00

Tester : V7186186

Operator : JUN

Serial No. : 965536810182523

SAP-Code : 96553681

Pump type :

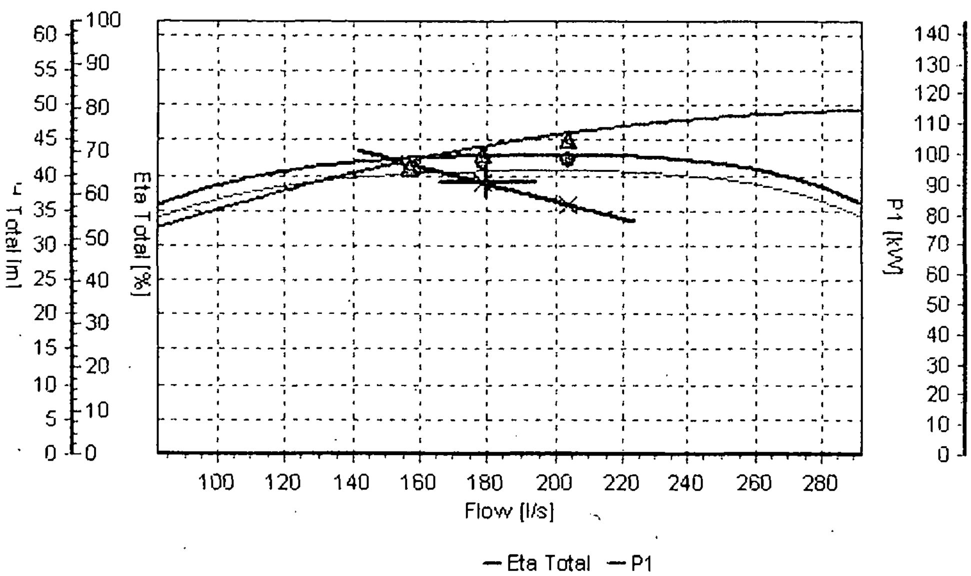
stomer request :

	Flow (l/s)	Head (m)
Duty point	**180.00**	**39.00**

/ Grundfos Environment Finland Ab
Kaivokselantie 3-5, Vantaa
P.O. Box 1036
Fin-00101 Helsinki
Phone: +358 9 561 420
Fax: +358 9 563 3989

Test results for serial no. : 965536810182523

	Flow (l/s)	Head (m)	U1 (V)	U2 (V)	U3 (V)	I avg. (A)	P1 (kW)	Eta (%)
Point 1	157.07	41.55	413	413	413	165.1	95.2	67.4
Point 2	178.37	38.89	412	413	413	171.5	100.2	67.8
Point 3	203.63	35.77	413	413	413	178.0	104.6	67.9



Page 2

Test Report for Pump

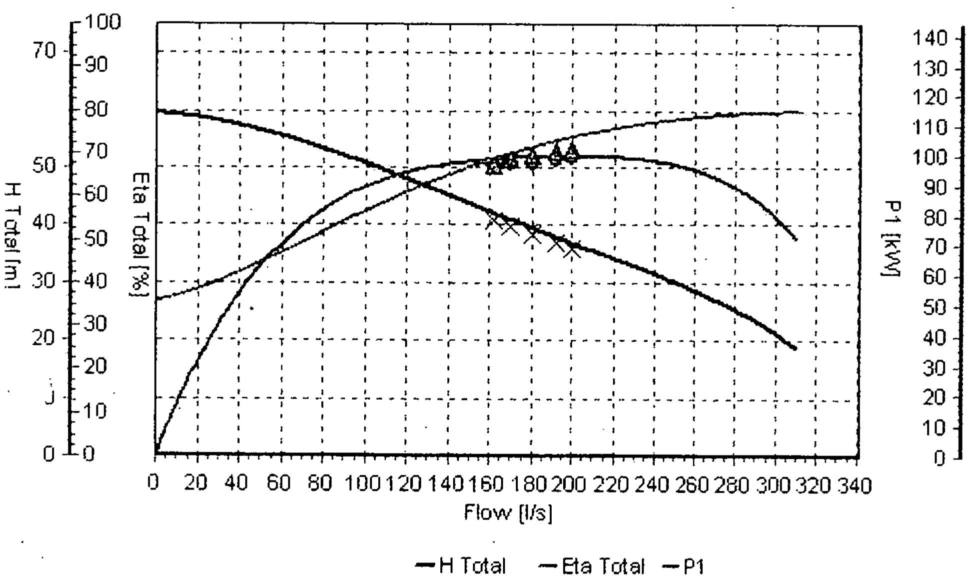
Manual test procedure

GRUNDFOS

C No.:		Date of test :	16.10.2004 08:44
Operator :	JUN	Tester :	V7186186

Serial no. :	96553681B182523	SAP-code :	96553681
Pump Type :			

	Flow (l/s)	Head (m)	U1 (V)	U2 (V)	U3 (V)	I avg. (A)	P1 (kW)	Eta (%)
Point 1	162.00	40.69	412	413	413	166.3	96.5	67.2
Point 2	169.35	39.96	412	413	413	169.0	98.4	67.6
Point 3	180.47	38.32	413	413	413	172.1	100.4	67.8
Point 4	191.90	37.00	413	413	413	173.3	101.5	68.5
Point 5	199.33	36.00	413	413	413	175.1	102.4	69.1



Grundfos Environment Finland Ab
Kaivokselantie 3-5, Vantaa
P.O. Box 1036
Fin-00101 Helsinki
Phone: +358 9 561 420
Fax: +358 9 563 3989

Test Report for Pump

Manual test procedure

GRUNDFOS

O No.:

Date of test : 16.10.2004 08:44

Operator : JUN

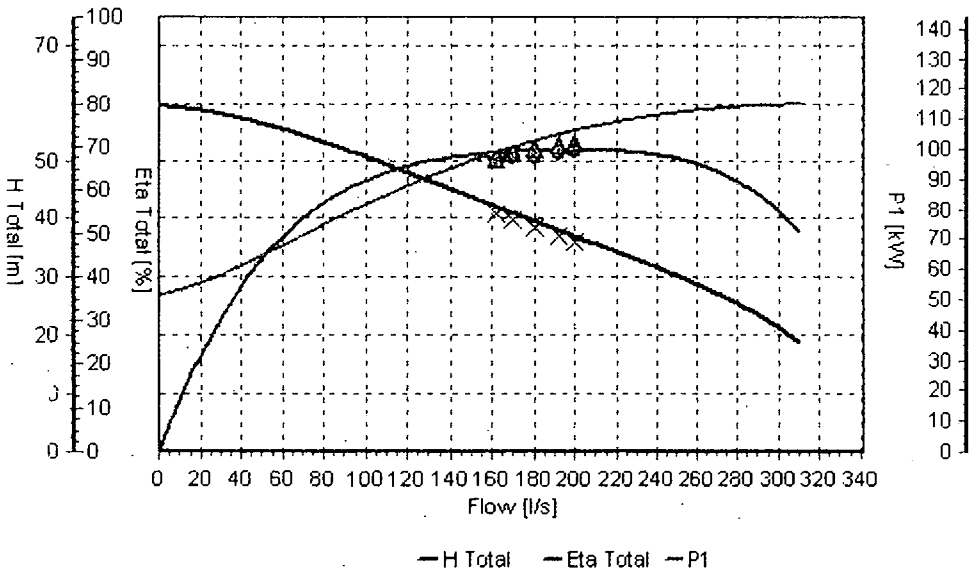
Tester : V7186186

Serial no. : 96553681B182523

SAP-code : 96553681

Pump Type :

	Flow (l/s)	Head (m)	U1 (V)	U2 (V)	U3 (V)	I avg. (A)	P1 (kW)	Eta (%)
Point 1	162.00	40.69	412	413	413	166.3	96.5	67.2
Point 2	169.35	39.96	412	413	413	169.0	98.4	67.6
Point 3	180.47	38.32	413	413	413	172.1	100.4	67.8
Point 4	191.90	37.00	413	413	413	173.3	101.5	68.5
Point 5	199.33	36.00	413	413	413	175.1	102.4	69.1



Grundfos Environment Finland Ab
Kaivokselantie 3-5, Vantaa
P.O. Box 1036
Fin-00101 Helsinki
Phone: +358 9 561 420
Fax: +358 9 563 3989

GRUNDFOS

ELECTRIC MOTOR TEST REPORT

Pump manufacturer: OY GRUNDFOS ENVIRONMENT FINLAND AB
Pump ordered by: Grundfos Pumps PTY.LTD
Purchase order no: 79353
Manufacturers order no.: 114645
Items:

Motor: HU195071A13ZB93
Pump: S21154M3B513ZB93
Serial no. 182521

This certifies that the motors have been tested in production process as follows:

- Tightness of the motor, testing pressure 0.8 bar
- Dielectric test
- Insulation resistance test
- Earth continuity test
- Idle current test
- Protection device circuit.

Result of work test measurement: Motor has passed the tests

Vantaa, Finland 18/10/2004

OY GRUNDFOS ENVIRONMENT FINLAND AB

GRUNDFOS

ELECTRIC MOTOR TEST REPORT

Pump manufacturer:	OY GRUNDFOS ENVIRONMENT FINLAND AB
Pump ordered by:	Grundfos Pumps PTY.LTD
Purchase order no:	79353
Manufacturers order no.:	114645
Items:	
Motor:	HU195071A13ZB93
Pump:	S21154M3B513ZB93
Serial no.	182522

This certifies that the motors have been tested in production process as follows:

- Tightness of the motor, testing pressure 0.8 bar
- Dielectric test
- Insulation resistance test
- Earth continuity test
- Idle current test
- Protection device circuit.

Result of work test measurement: Motor has passed the tests

Vantaa, Finland 18/10/2004

OY GRUNDFOS ENVIRONMENT FINLAND AB

GRUNDFOS

ELECTRIC MOTOR TEST REPORT

Pump manufacturer:		OY GRUNDFOS ENVIRONMENT FINLAND AB
Pump ordered by:		Grundfos Pumps PTY.LTD
Purchase order no:		79353
Manufacturers order no.:		114645
Items:		
	Motor:	HU195071A13ZB93
	Pump:	S21154M3B513ZB93
	Serial no.	182523

This certifies that the motors have been tested in production process as follows:

- Tightness of the motor, testing pressure 0.8 bar
- Dielectric test
- Insulation resistance test
- Earth continuity test
- Idle current test
- Protection device circuit.

Result of work test measurement: Motor has passed the tests

Vantaa, Finland 18/10/2004

OY GRUNDFOS ENVIRONMENT FINLAND AB

GRUNDFOS

HYDROSTATIC PRESSURE TEST REPORT

Pump manufacturer:	OY GRUNDFOS ENVIRONMENT FINLAND AB
Pump ordered by:	Grundfos Pumps PTY.LTD
Purchase order no:	79353
Manufacturers order no.:	114645
Pump Type:	S21154M3B513ZB93
SAP Code	96553681
Serial no.	182521
Volute Casing No.	13709A

This certifies that the volute casing has been type tested with water as follows:

Pressure:	10.5 bar
Holding time:	5 minutes.

Result: Neither leakage nor breaks have been found at visual examination.

Vantaa, Finland 18/10/2004

OY GRUNDFOS ENVIRONMENT FINLAND AB

GRUNDFOS

HYDROSTATIC PRESSURE TEST REPORT

Pump manufacturer:	OY GRUNDFOS ENVIRONMENT FINLAND AB
Pump ordered by:	Grundfos Pumps PTY.LTD
Purchase order no:	79353
Manufacturers order no.:	114645
Pump Type:	S21154M3B513ZB93
SAP Code	96553681
Serial no.	182522
Volute Casing No.	13709A

This certifies that the volute casing has been type tested with water as follows:

Pressure:	10.5 bar
Holding time:	5 minutes.

Result: Neither leakage nor breaks have been found at visual examination.

Vantaa, Finland 18/10/2004

OY GRUNDFOS ENVIRONMENT FINLAND AB

GRUNDFOS

HYDROSTATIC PRESSURE TEST REPORT

Pump manufacturer:	OY GRUNDFOS ENVIRONMENT FINLAND AB
Pump ordered by:	Grundfos Pumps PTY.LTD
Purchase order no:	79353
Manufacturers order no.:	114645
Pump Type:	S21154M3B513ZB93
SAP Code	96553681
Serial no.	182523
Volute Casing No.	13709A

This certifies that the volute casing has been type tested with water as follows:

Pressure:	10.5 bar
Holding time:	5 minutes.

Result: Neither leakage nor breaks have been found at visual examination.

Vantaa, Finland 18/10/2004

OY GRUNDFOS ENVIRONMENT FINLAND AB

3.2

5.3 Harmonic Filter Commissioning

5.3.1 Purpose

The harmonic filter is to be commissioned and tests to be conducted to verify the unit has the calculate effect on the harmonic portion of the VSD system.

5.3.2 Scope

Energy Correction Option (ECO) to commission the harmonic filter and record harmonics as detailed in the specification. The recording will involve installing three current transformers and voltage clamps, and a neutral within the switchboard. The FRAKO EMA1100, the same manufacturer as the controller installed in the harmonic filter, shall be utilised to conduct the recordings

5.3.3 Procedures

<u>Harmonic Filter Commissioning</u>

1. Check tension of all bolted connections within the unit
2. Meggar testing of insulation and earthing system
3. Switching on and programming the harmonic filter controller

<u>Harmonics Recording</u>

The proposed parameters that will be monitored are 5th, 7th, 11th, 13th, 15th, and 17th voltage harmonics.

The planned procedure for the recordings would be to run the motors without the harmonic filter switched on and record the harmonics under the operating condition specified in the contract.

Next, the harmonic filter is turned on, and the harmonics recorded under the operating condition in the contract specification.

These recordings will be graphed and presented within a written commissioning report.

rotation direction. Changes to phasing to obtain correct motor rotation shall be done on the motor feeder cables only. After correct rotation has been confirmed, Variable Speed Drives shall be operated at various speeds and the voltage, current, motor power, speed, flow rate (where available), discharge pressure and wet well level shall be recorded.

In accordance with Brisbane Water Specification PSE-SSM018 clause 5.3.5, the Contractor shall provide a record of actual harmonics generated at the Heroes Avenue and Patrick Lane Pump Stations. The records shall include harmonics recorded under the following operating conditions:

For No load measurements, all equipment shall be disconnected from the supply.

Heroes Avenue Pump Station

Station Load	Pump Operation	
No load	No pumps operating	
25%	Two pumps operating at 25%	33Hz
50%	Two pumps Operating at 50%	39Hz
75%	Two pumps Operating at 75%	45Hz
100%	Two pumps Operating at 100%	50Hz

Patrick Lane Pump Station

Station Load	Pump Operation
No load	No pumps operating
25%	One pump operating at 25%
50%	One pump Operating at 50%
75%	One pump Operating at 75%
100%	One pump Operating at 100%

Harmonic distortion levels must not exceed the limits allowed by AS 2279.2.

~~*3.3.3.4 Soft Starters*~~

~~Soft starters shall be programmed with all relevant details and the settings recorded. The soft starters shall be operated briefly to determine motor rotation direction. After correct rotation has been confirmed, the motors shall be operated and the voltage, current, motor power, flow rate, discharge pressure and wet well level shall be recorded.~~

3.3.3.4 Instrumentation

Instruments shall be calibrated using wet well drop tests where practical. Correct operation shall be verified during operation.

ECO

CAPACITOR TECHNOLOGIES

73kVAr PASSIVE HARMONIC FILTER

BRISBANE CITY COUNCIL
M&E FITOUT
HEROES AVENUE

COMMISSIONING REPORT

EQUIPMENT NUMBER: LSW73-415-BR
SERIAL NUMBER: CT-3750E1

DATED: 15.8.05

PREPARED BY: Paul A. Lucas

Energy Correction Options – ABN 66 085 765 751
P.O. Box 431 Kelvin Grove 4059 • Telephone: (07) 3356 0577 • Fax (07) 3356 1432

Brisbane City Council
Harmonic Filter Commissioning Report

Introduction

The commissioning of the Harmonic Filter included the recording of the voltage and current total harmonic distortions under the load conditions shown in the specification.

The Australian Standard AS 2279.2 referred to in the Brisbane Water specification states that the total harmonic voltage distortion should not exceed 5% and that odd harmonics be less than 4%.

The Australian Standards do not specify a limit for current distortion.

Technical details on the FRAKO monitoring equipment that was used to perform the recordings are attached to this report.

Report

The parameters measured were,

1. Power – kW in the individual phases
2. Total Voltage Harmonic Distortion in the individual phases
3. Total Current Harmonic Distortion in the individual phases
4. 3rd, 5th and 7th harmonics in the red phase
5. 9h, 11th and 13th harmonics in the red phase.

Note that because the 9th, 11th and 13th harmonics are low, they have been printed using a different scale on the "Y" axis.

The dashed black line on the recordings, indicate when the Harmonic Filter was switched on.

Brisbane City Council
Harmonic Filter Commissioning Report

Conclusion

The Total Harmonic Distortion – Voltage recording shows that at 100% load the voltage distortion does exceed 5% and the when the Harmonic Filter is switched on this reduces to 3.7%.

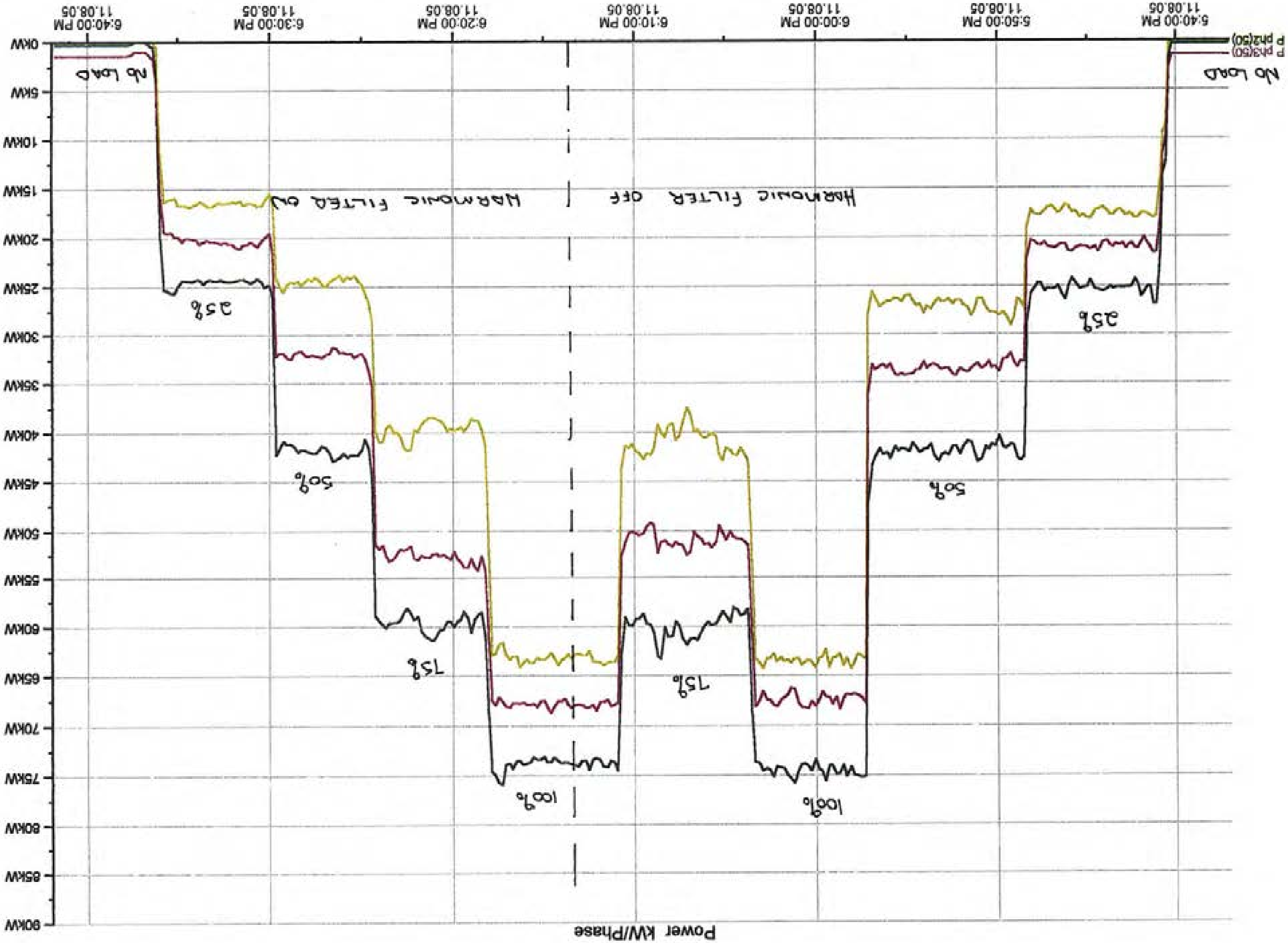
With the Harmonic Filter operating the odd harmonics are less than half of the allowable 4%.

In my opinion, the alarm contacts should be disconnected because under no load conditions the controller for the Harmonic Filter assumes that there is a fault with the current transformer used to monitor the current. This current transformer is located within the Main Switchboard.

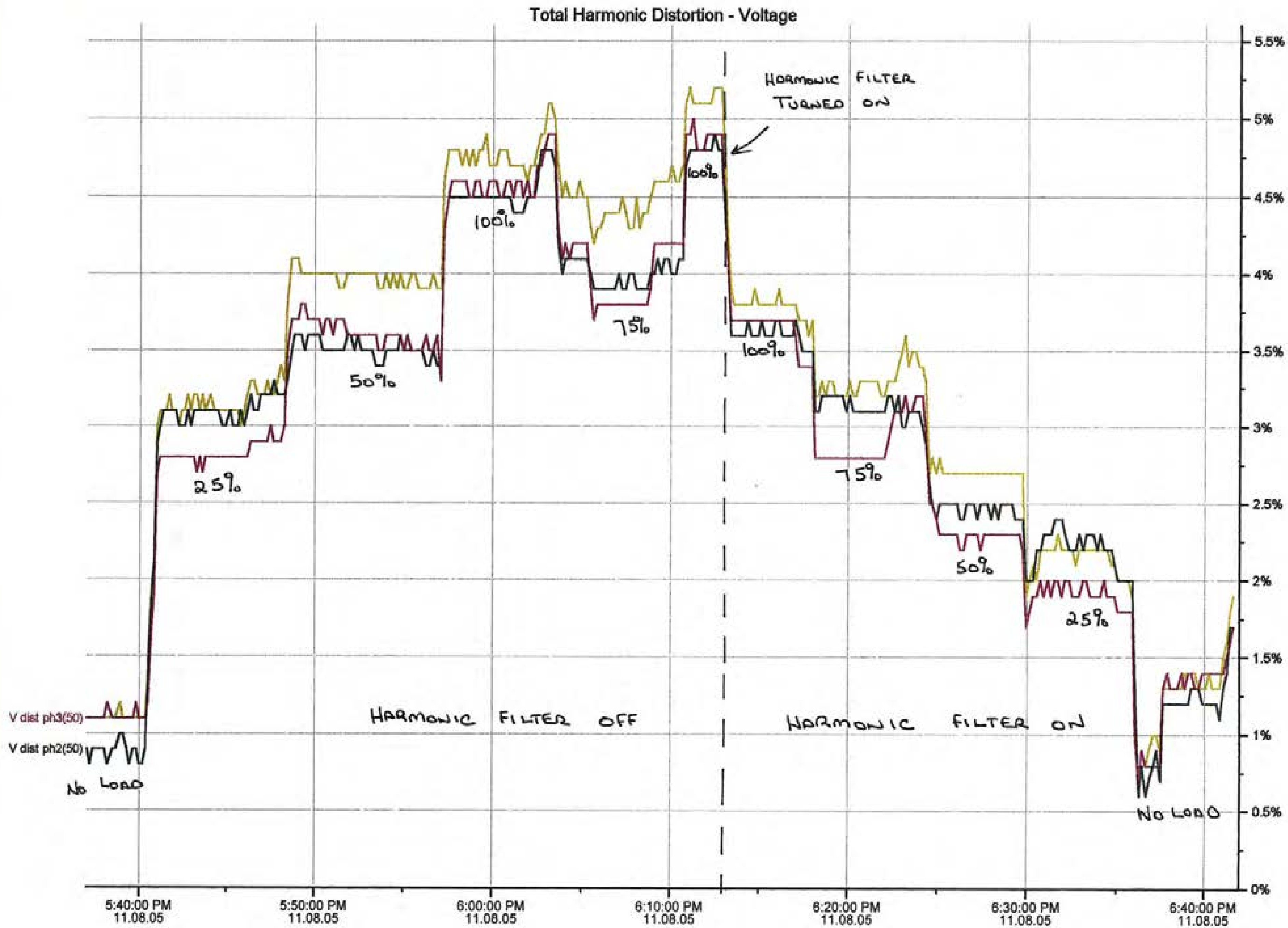
The display will flash I=O and the contacts on the relay will close. This will cause a false indication of a fault with the Harmonic Filter.

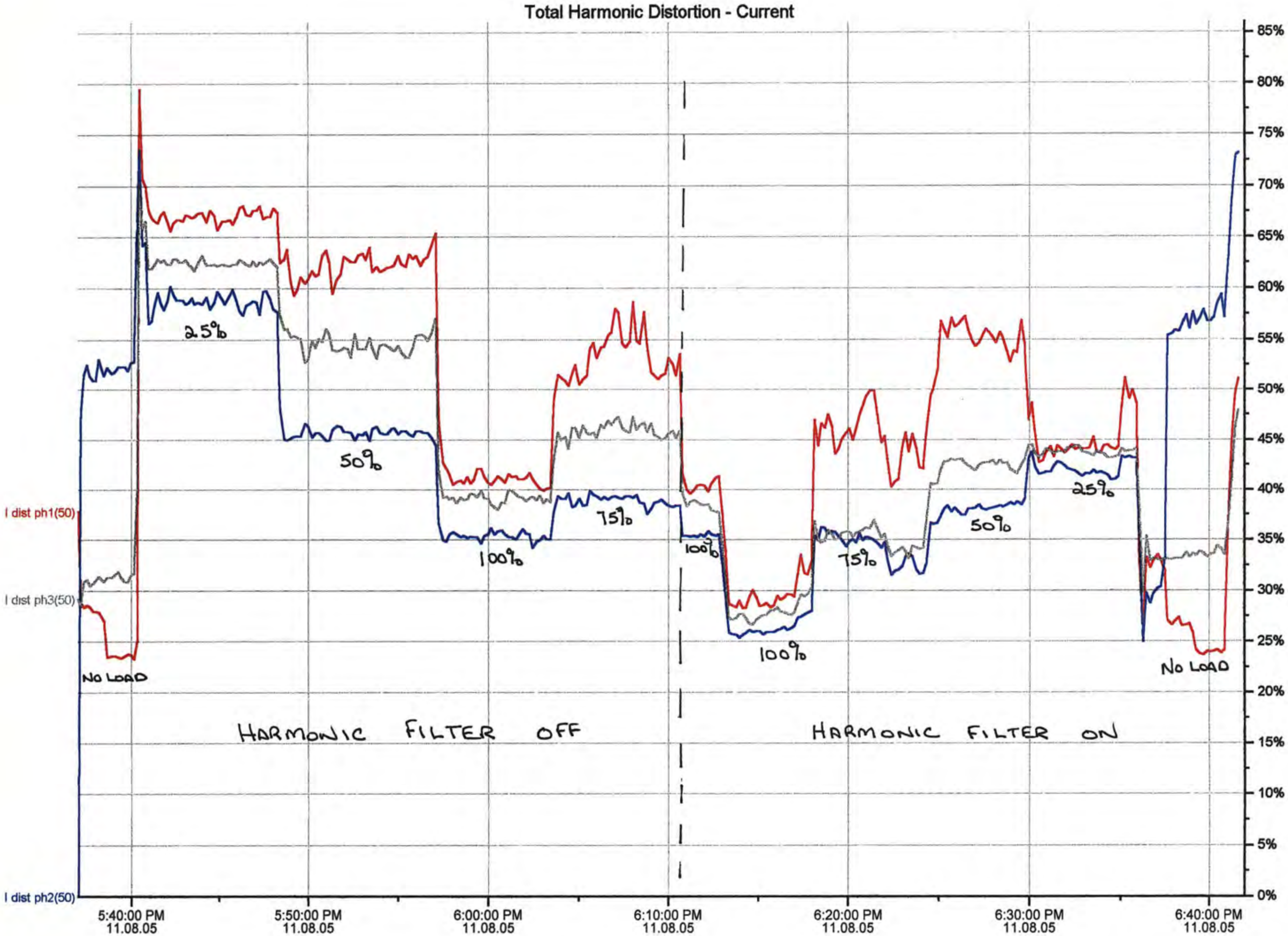
Brisbane City Council
Harmonic Filter Commissioning Report

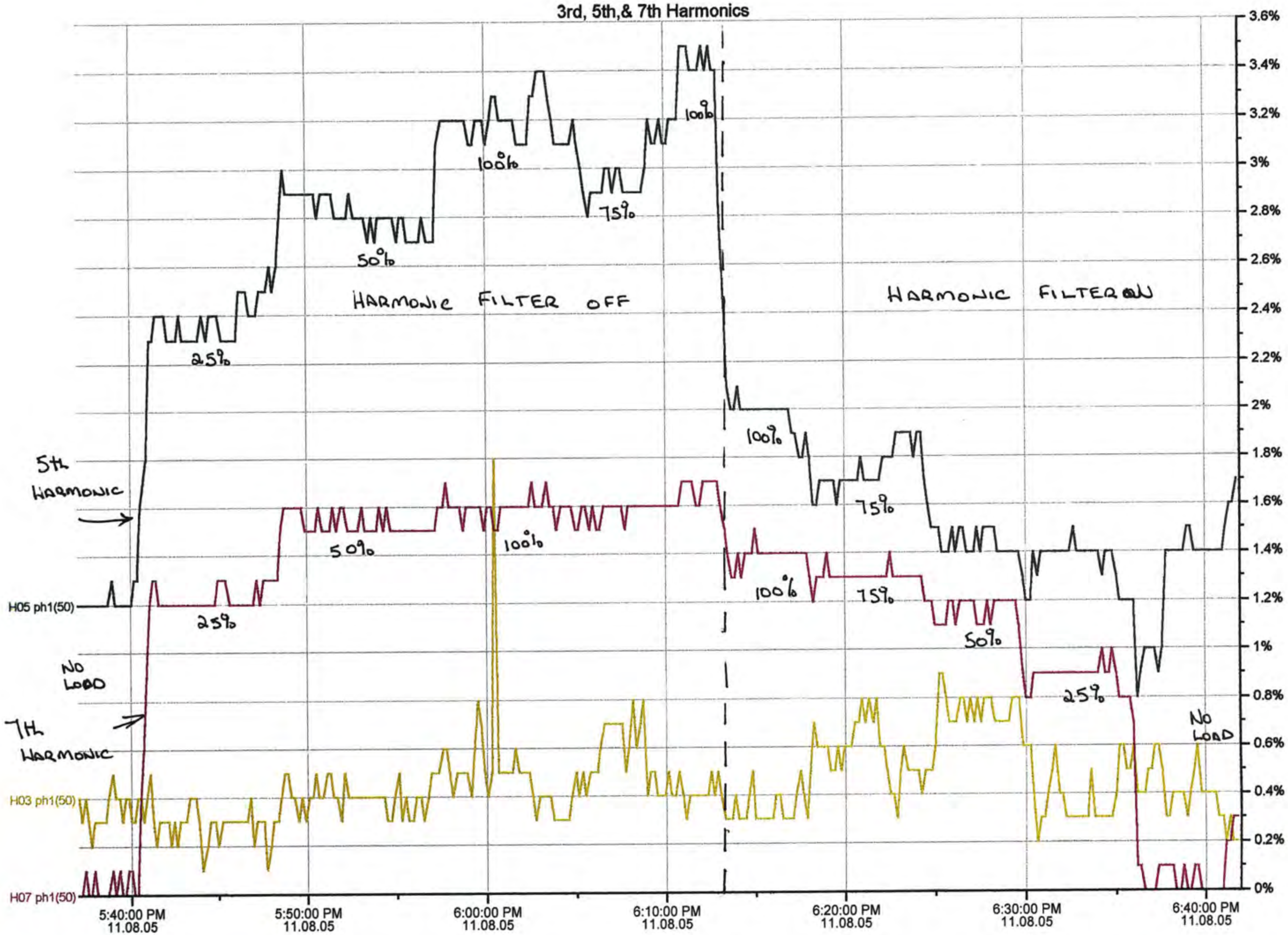
RECORDINGS

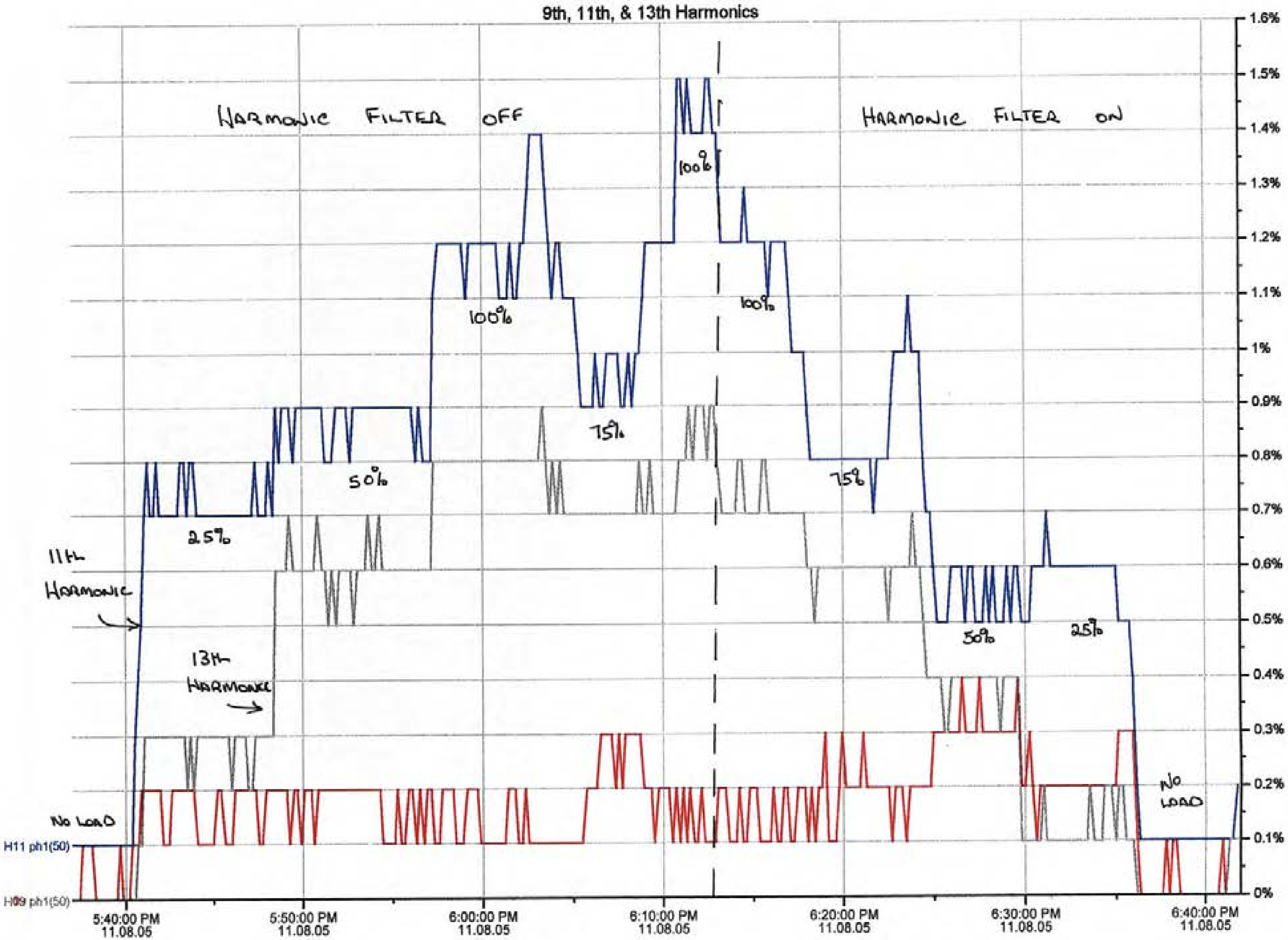


Power KW/Phase
P ph2(50)
P ph3(50)
No Load
25%
50%
75%
100%
Harmonic Filter ON
Harmonic Filter OFF


Total Harmonic Distortion - Voltage
5.5%
5%
4.5%
4%
3.5%
3%
2.5%
2%
1.5%
1%
0.5%
0%
V dist ph3(50)
V dist ph2(50)
HARMONIC FILTER TURNED ON
NO LOAD
25%
50%
100%
75%
100%
100%
75%
50%
25%
NO LOAD
HARMONIC FILTER OFF
HARMONIC FILTER ON
5:40:00 PM 11.08.05
5:50:00 PM 11.08.05
6:00:00 PM 11.08.05
6:10:00 PM 11.08.05
6:20:00 PM 11.08.05
6:30:00 PM 11.08.05
6:40:00 PM 11.08.05


Total Harmonic Distortion - Current
85%
80%
75%
70%
65%
60%
55%
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
I dist ph1(50)
I dist ph3(50)
I dist ph2(50)
5:40:00 PM 11.08.05
5:50:00 PM 11.08.05
6:00:00 PM 11.08.05
6:10:00 PM 11.08.05
6:20:00 PM 11.08.05
6:30:00 PM 11.08.05
6:40:00 PM 11.08.05
NO LOAD
25%
50%
100%
75%
100%
100%
75%
50%
25%
NO LOAD
HARMONIC FILTER OFF
HARMONIC FILTER ON

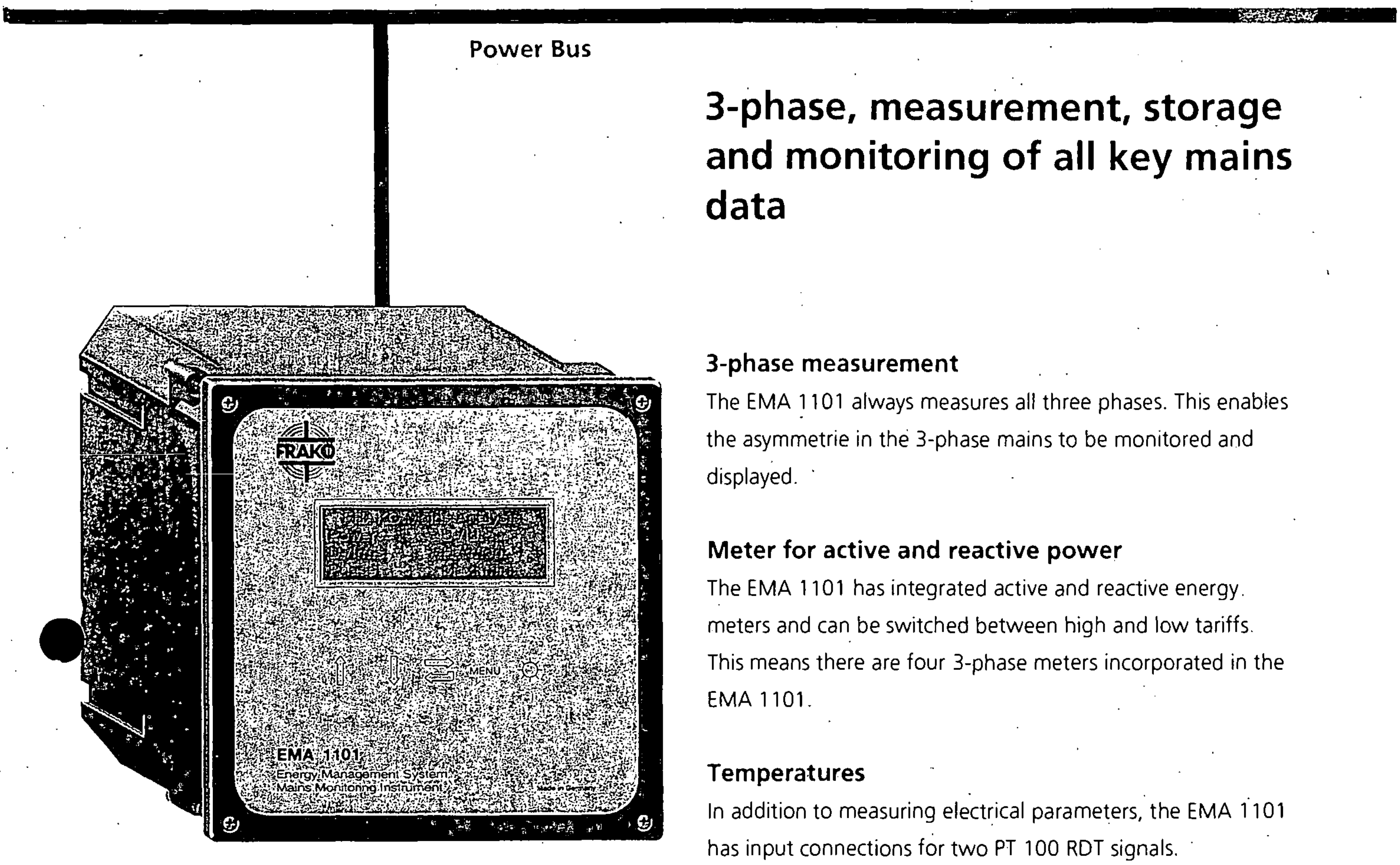

3rd, 5th,& 7th Harmonics
HARMONIC FILTER OFF
HARMONIC FILTER ON
5th HARMONIC
7th HARMONIC
NO LOAD
NO LOAD
25%
50%
100%
75%
100%
100%
75%
50%
25%
H05 ph1(50)
H03 ph1(50)
H07 ph1(50)
3.6%
3.4%
3.2%
3%
2.8%
2.6%
2.4%
2.2%
2%
1.8%
1.6%
1.4%
1.2%
1%
0.8%
0.6%
0.4%
0.2%
0%
5:40:00 PM 11.08.05
5:50:00 PM 11.08.05
6:00:00 PM 11.08.05
6:10:00 PM 11.08.05
6:20:00 PM 11.08.05
6:30:00 PM 11.08.05
6:40:00 PM 11.08.05


9th, 11th, & 13th Harmonics
HARMONIC FILTER OFF
HARMONIC FILTER ON
100%
75%
50%
25%
11th HARMONIC
13th HARMONIC
NO LOAD
H11 ph1(50)
H09 ph1(50)
1.6%
1.5%
1.4%
1.3%
1.2%
1.1%
1%
0.9%
0.8%
0.7%
0.6%
0.5%
0.4%
0.3%
0.2%
0.1%
0%
5:40:00 PM 11.08.05
5:50:00 PM 11.08.05
6:00:00 PM 11.08.05
6:10:00 PM 11.08.05
6:20:00 PM 11.08.05
6:30:00 PM 11.08.05
6:40:00 PM 11.08.05

TECHNICAL DETAILS ON THE MONITORING EQUIPMENT

FRAKO Kondensatoren- und Anlagenbau GmbH

Mains Monitoring Instrument EMA 1101



3-phase, measurement, storage and monitoring of all key mains data

3-phase measurement

The EMA 1101 always measures all three phases. This enables the asymmetrie in the 3-phase mains to be monitored and displayed.

Meter for active and reactive power

The EMA 1101 has integrated active and reactive energy meters and can be switched between high and low tariffs. This means there are four 3-phase meters incorporated in the EMA 1101.

Temperatures

In addition to measuring electrical parameters, the EMA 1101 has input connections for two PT 100 RDT signals.

Practical power factor monitoring

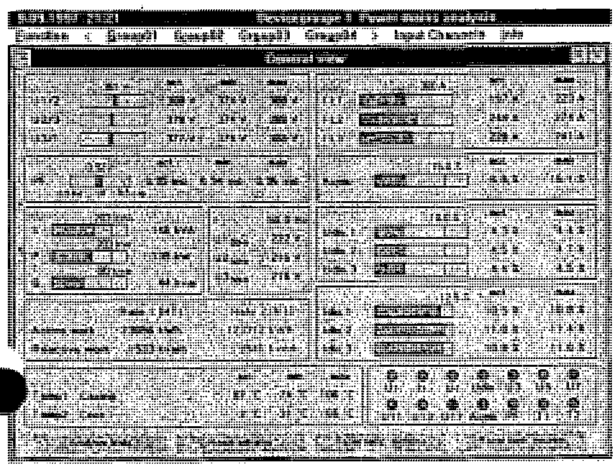
Monitoring power factor is not particularly difficult. With the EMA 1101, however, the power at which the monitoring is to become effective can be set and thus avoids unnecessary alarms.

All system configurations

Adaptation to special system configurations is possible by means of a voltage transformer with high measurement accuracy.

User-friendly operation

The EMA 1101 not only has many functions but is also easy and efficient to operate.
You can access all measurement readings via the user-friendly menu-driven dialogue.



Display of the measurement readings from the EMA 1101 mains monitoring instrument

FRAKO Kondensatoren- und Anlagenbau GmbH

FRAKO

Mains Monitoring Instrument EMA 1101

Description:

Microprocessor-based 3-phase measurement and monitoring instrument for the acquisition, analysis and monitoring of electrical measurement data in medium- and low-voltage mains, with automatic measurement range switching and suitable for connection to the FRAKO Power Bus.

- Menu-driven program in plain language and display of 6 analysis parameters simultaneously for direct comparison
- Measurement via external current transformers
- When variables go outside set limits alarm signals in plain language and via volt-free contacts
- Menu-driven programming in plain language with interactive dialogue
- Backup for meter readings and alarm limits in the case of power failure
- Display of measurement readings by backlit LCD window with four rows each of 20 characters
- Interface to FRAKO Power Bus for remote indication of measurement readings, alarm settings and waveshape for current and voltage, remote operation, programming of alarm settings and management of historical data (daily curves) at the PC.

Data storage:

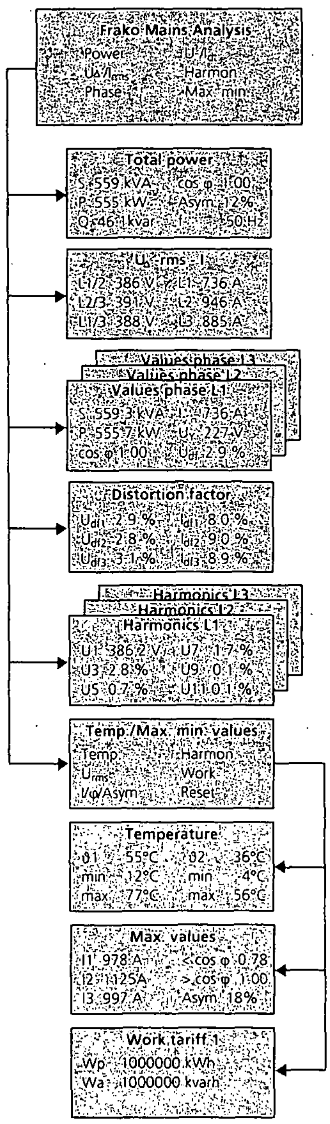
- 3 x max. phase currents
- Min./max. cos φ
- Max. asymmetry
- 3 x min./max. voltage
- 3 x max. harmonic distortion of voltage
- 3 x max. harmonics U 3, U 5,...U 19
- 2 x min./max. temperature (via ext. Pt 100 RTDs)

Monitoring of set limits with alarm messages (volt-free contact) for:

- Max. current
- Min./max. voltage
- Min. cos φ
- Max. asymmetry
- Max. harmonic distortion of voltage
- Max. harmonics (U 3, U 5, U 7, U 11, U 13, U 17)
- 2x min./max. temperature

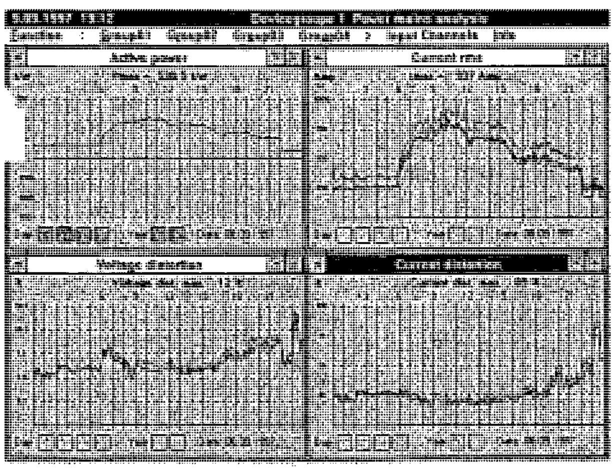
Indicated measurement readings:

- Voltages (phase-to-phase and phase-to-neutral) of phase conductors
- Phase conductor current
- Cos φ, active and reactive power of phase conductors
- Frequency
- Asymmetry
- Harmonic distortion of voltage and current in phase conductors
- Proportion of 3rd, 5th, ... 19th harmonic components
- 2x active and reactive power with external tariff switching



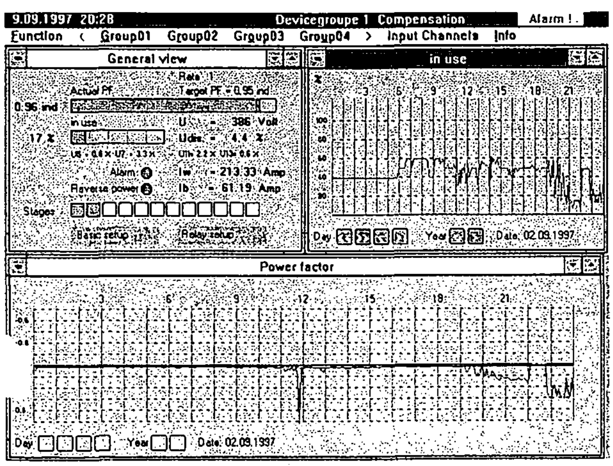
Windows visualisation software

The monitoring program is a software item included in the scope of delivery of the bus central unit. It serves the archiving, display and reporting of the current instrument readings and daily curves from the instruments connected to the Power Bus processed by the EMZ.
Using the monitoring program, all key parameters of the instruments connected to the Power Bus can be configured by means of user-friendly data entry windows.
If the variables of any connected instruments go beyond the alarm limits, then this is immediately displayed in plain language. Graphics created with the practical user in mind allow you to monitor your energy data with an uncomplicated overview.



Display of the measurement readings from the EMA 1101 mains monitoring instrument

Graphics with a logical structure give a clear overview at all times of mains quality and enable you to identify and avoid faults or even breakdowns.



Display of the measurement readings from the EMR 1100 Reactive Power Control Relay

The continuous monitoring of the power factor correction helps you to identify overloading of the power factor correction system in good time and therefore avoid unnecessary reactive current costs. Set parameters can be changed easily at any time.

APPENDIX A

BW NCS Pre-Commissioning Acceptance Test Document

BRISBANE WATER

Network Control Systems

IDTS POINT COMMISSIONING SHEET AND GENERATOR SUPPLY OPERATIONAL CHECKS

SP : 103 M.

Location : Heroes Ave.

Project & Commissioning Details

Date Commissioned	11-05-05
Project Manager	Andy Mo[illegible].
Construction Manager	Mike [illegible]ridge
Electrical Inspector	Ray McG[illegible]
RTU Programmer	Alex Witthe[illegible]
Electricians	Frank Kerr for HV4C

POINT TO POINT

All the I/O internal to the switchboard should have been tested during the factory test. Confirm that the Factory test sheet has been completed and all I/O has been tested to the terminal strip. The following tests the remote IO from the Generator via the control cable. The IO MAP below is provided to trace each point from the Generator all the way to IDTS

IDTS Plant and Quantity	IsaGraf TAG	Switchboard Drawing	Switch board Relay	Generator Drawing	Connec tion Pin #	Gen. PLC Add.	Gen. PLC Tag	Gen. Tag Desc.
Common_fault	gen1tripped	Generator Fault	GFR	Gen Shutdown Alarm	4	%Q0035	GEN_SD_ALM	BCC Generator Shutdown Alarm
Warning	gen1warning	Generator Warning	GWR	Gen Warning Alarm	5	%Q0036	GEN_W_ALM	BCC Generator Warning Alarm
Low_fuel	gen1lowFuel	Generator Low Fuel	GLFR	Low Fuel	6	%Q0037	FUEL_LOW	BCC Low Fuel
Running	gen1running	Generator Running	GRR	Generator Running	7	%Q0038	GEN_RUN	BCC Generator Running
Connected	gen1connected	Generator Connected	GCR	Generator Connected	8	%Q0039	GEN_CON	BCC Generator Connected
Energex Power	sn1energexPower	Energex Power Failure Relay	PFR1	Phase Failure	9 & 10	%I0033	MAINS_FAILED	BCC Mains Failed
Door_status	gen1security	Generator security	GDR	T.B.A.	20	%Q0043	SDAR	Generator Shunt Trip Relay
CB_tripped	gen1locCBtripped	Generator C/B Status	GCBT	T.B.A.	21	%Q0044	DOORS_OPEN	BCC Doors Open Alarm
Auto	gen1auto	Generator Mode	GMR	T.B.A.	22	%Q0045	GEN_AUTO	Generator Auto Mode
Offsite	gen1onSite	Generator On Site	'LINK'	N/A	23-24	N/A	N/A	N/A
Remote_run_request	gen1Start	Generator Remote Start	GRST	Remote Start	15 & 16	%I0036	REM_STR	BCC Remote Start
Remote_stop_request	gen1Stop	Generator Remote Stop	GRSP	Remote Stop	17 & 18	%I0037	REM_STP	BCC Remote Stop
N/A	N/A	24V –ve	-	24V -ve	1	N/A	N/A	N/A
N/A	N/A	Close Mains ATS CB	MCBR	Close Mains ATS	2	%Q0033	MAINS_ATS_OPN_CMD	
N/A	N/A	Close Generator ATS CB	GCBR	Close Gen ATS	3	%Q0034	GEN_ATS_CLS_CMD	
N/A	N/A	Mains ATS CB Status	MCB-aux	Mains On Line	11 & 12	%I0034	MAINS_ATS_CLS	BCC Mains ATS Closed
N/A	N/A	Generator ATS CB Status	GCB-aux	Gen On Line	13 & 14	%I0035	GEN_ATS_CLS	BCC Generator ATS Closed

GENERATOR COMMON FAULT

Action	Observation	Results RTU	Results IDTS
Make the Generator common fault alarm active	Confirm that GENERATOR COMMON_FAULT alarm is received by IDTS	✓	✓
Deactivate the Generator common fault alarm	Confirm that GENERATOR COMMON_FAULT alarm return to normal is received by IDTS	✓	✓

GENERATOR WARNING

Action	Observation	Results RTU	Results IDTS
Make the Generator warning alarm active (except by low fuel).	Confirm that GENERATOR WARNING alarm is received by IDTS	✓	✓
Deactivate the Generator warning alarm	Confirm that GENERATOR WARNING alarm return to normal is received by IDTS.	✓	✓

GENERATOR LOW FUEL

Action	Observation	Results RTU	Results IDTS
Make the Generator low fuel warning alarm active	Confirm that GENERATOR LOW_FUEL alarm and the WARNING alarms is NOT received by IDTS. (The WARNING signal to the RTU will however be true, but alarm suppressed by LOW FUEL.	✓	✓
Deactivate the Generator low fuel warning alarm	Confirm that GENERATOR LOW_FUEL alarm return to normal is received by IDTS.	✓	✓

GENERATOR RUNNING

Action	Observation	Results RTU	Results IDTS
Start the Generator (off line only)	Confirm that GENERATOR RUNNING alarm is received by IDTS	✓	✓
Stop the Generator	Confirm that GENERATOR RUNNING alarm return to normal is received by IDTS	✓	✓

GENERATOR CONNECTED

Action	Observation	Results RTU	Results IDTS
Start the Generator on line	Confirm that GENERATOR RUNNING alarm and the GENERATOR CONNECTED alarm are received by IDTS	✓	✓
Stop the Generator	Confirm that GENERATOR RUNNING alarm and CONNECTED alarm return to normal	✓	✓

Site FAT by (RTU Programmer)		Pre-commissioning Test Sheet checked by NCS Project Officer	
Name:	Alex Wittlef	Name:	Peter Sherriff
Signature:	[signature]	Signature:	[signature]
Date:	11-08-05	Date:	15-08-05

STATION ENERGEX POWER

Action	Observation	Results RTU	Results IDTS
Fail the Energex Power to the switchboard (via Main CB).	Confirm that the SITE ENERGEX POWER alarm is activated and received by IDTS	✓	✓
Return Energex Power to the switchboard	Confirm that SITE ENERGEX POWER alarm and CONNECTED alarm return to normal	✓	✓

GENERATOR DOOR STATUS

Action	Observation	Results RTU	Results IDTS
Open a canopy door on the Generator	Confirm that SECURITY DOOR_LIMIT_SWITCH alarm is received by IDTS	✓	✓
Close the canopy door	Confirm that SECURITY DOOR_LIMIT_SWITCH alarm return to normal is received by IDTS	✓	✓

GENERATOR CB TRIPPED

Action	Observation	Results RTU	Results IDTS
Trip the Generator circuit breaker	Confirm that GENERATOR CB_TRIPPED alarm is received by IDTS	✓	✓
Reset the Generator circuit breaker	Confirm that GENERATOR CB_TRIPPED alarm return to normal is received by IDTS	✓	✓

GENERATOR AUTOMATIC

Action	Observation	Results RTU	Results IDTS
Turn the generator to local mode	Confirm that GENERATOR AUTOMATIC alarm is received by IDTS	✓	✓
Return the generator to automatic mode	Confirm that GENERATOR AUTOMATIC alarm return to normal is received by IDTS	✓	✓

GENERATOR ON SITE

Action	Observation	Results RTU	Results IDTS
Connect the Control interface lead to the station	Confirm that GENERATOR OFFSITE alarm return to normal is received by IDTS	✓	✓
Disconnect the Control interface lead to the station	Confirm that GENERATOR OFFSITE alarm is received by IDTS	✓	✓

Site FAT by (RTU Programmer)

Name: Alex Withell

Signature:

Date: 11-08-05

Pre-commissioning Test Sheet checked by NCS Project Officer

Name: PETER SHERRIFF

Signature:

Date: 15-08-05

GENERATOR REMOTE START AND STOP

Action	Observation	Result
Confirm the Generator is available to run, but not running		☑ OK
Set the IDTS control point GENERATOR REMOTE_RUN_REQUEST and send to the site	Confirm that the Generator starts and runs off-line	☑ Yes
	Confirm that GENERATOR RUNNING alarm is received by IDTS	☑ Yes
Set the IDTS control point GENERATOR REMOTE_STOP_REQUEST and send to the site	Confirm that the Generator stops	☑ Yes
	Confirm that GENERATOR RUNNING alarm return to normal is received by IDTS	☑ Yes

Site FAT by (RTU Programmer)

Name: Alex Whitworth

Signature: [signature]

Date: 11-08-05

Pre-commissioning Test Sheet checked by NCS Project Officer

Name: PETER SHERRIFF

Signature: [signature]

Date: 15-08-05

GENERATOR FUNCTIONAL TESTING

LOCALMODE

Action	Observation	Result
Ensure the Generator is in Automatic mode, the pumps are selected for local mode and there is enough sewage in the well for the pumps to run continuously for one minute.		☑ OK
Fail the Energex power to the Generator	Confirm that the Generator starts and supplies power to the station	☑ Yes
	Confirm that GENERATOR CONNECTED alarm is received by IDTS	☑ Yes
Start the maximum allowed pumps in local mode.	Confirm that the correct number of pumps (available under Generator supply) start in sequence. (10 seconds appart).	☑ Yes (2 pumps)
Restore Energex power and record the time taken for the Generator controller to return the station power to Energex supply	Time for station power to return to Energex supply	......✓(sec)
	Confirm that GENERATOR CONNECTED alarm return to normal is received by IDTS	☑ Yes
Record time taken for the Generator to stop after station power to returns to Energex supply	Time for Generator to stop after station power to returns to Energex supply	360 (sec)

REMOTE MODE – SURCHARGE IMMINENT MODE

Action	Observation	Result
Activate the surcharge imminent probe for at least 10 sec. with the level below the start level.	Confirm that WET_WELL SURCHARGE IMMINENT alarm is received by IDTS	☑ Yes
	Confirm that correct number of pumps start pumps start	☑ Yes 2 pumps
Fail the Energex power to the Generator	All pumps will stop. Confirm that the Generator starts and supplies power to the station. Confirm that the correct number of pumps start under the power of the Generator (at full speed)	☑ Yes ☑ Yes ✓ 2 pumps
Restore Energex power indication to the Generator and allow the Generator controller to return the station power to Energex supply	Confirm that when the power switches from the generator to Energex power that the pumps continune to run (ie flying start).	☑ Yes
Deactivate the Surcharge imminent probe	After the surcharge pumping mode is deactiveated, all pumps should stop	☑ Yes

Site FAT by (RTU Programmer)

Name: Alex Wittkopf

Signature: [signature]

Date: 7-09-05

Pre-commissioning Test Sheet checked by NCS Project Officer

Name: PETER SHERRIFF

Signature: [signature]

Date: 12-09-05

REVISION CONTROL **SP103 Heroes Ave Sewage Pumping Station**

Version	Date	Author	Comment
1.00		Alex Witthoft	Initial Version developed from SP300 Serpentine Rd
1.20		Alex Witthoft	Modification made during code development (updated ranges)
1.30	12-10-2004	Alex Witthoft	Moved the Site power from the PLC to the RTU.

Prepared by Alex Witthoft

28/10/2004

SP103 Heroes Ave Sewage Pumping Station

MITS MD3311

Port 2

RS485 MODBUS LINK

GE-Fanuc 90-30 PACK 0

	Slot 1	Slot 2	Slot 3	Slot 4	Slot 5	Slot 6	Slot 7	Slot 8	Slot 9	Slot 10
IC693 PWR 321	IC693 CPU350	IC693 CMM311	IC693 MDL645	IC693 MDL645	IC693 MDL645	IC693 MDL645	IC693 MLD940	IC693 ALG221	IC693 ALG221	IC693 ALG392
Power Supply 120/240 VAC	CPU 350	MODBUS COMMS	16 Point Digital Input 24VDC	16 Point Digital Input 24VDC	16 Point Digital Input 24VDC	16 Point Digital Input 24VDC	16 Point Ditital relay Output 2A	4 Channel Analog Input Current (Isolated)	4 Channel Analog Input Current (Isolated)	8 Channel Analog Output Current
		MODBUS 1	%I001 - %I016	%I017 - %I032	%I033 - %I048	%I049 - %I064	%Q001-%Q016	%AI001 - %AI04	%AI005 - %AI08	%AQ01 - %AQ08

Primary Backplane **IC693CHS391**

SP103 Heroes Ave Physical IO List Ver 1.3.xls

MITS DI (0-15)

Brisbane Water

MITS MD3311 EA (Extended I-O) DIGITAL INPUTS (0-15)

SP103 Heroes Ave Sewage Pumping Station

I/O #	Description	MITS Tag	Off State	On State	Term. #	Wire #	Drawing #	Comment
0	Spare	-	-	-		DI00		
1	Spare	-	-	-		DI01		
2	Spare	-	-	-		DI02		
3	Spare	-	-	-		DI03		
4	Spare	-	-	-		DI04		
5	Spare	-	-	-		DI05		
6	Spare	-	-	-		DI06		
7	Spare	-	-	-		DI07		
8	Spare	-	-	-		DI08		
9	Spare	-	-	-		DI09		
10	Spare	-	-	-		DI10		
11	Spare	-	-	-		DI11		
12	Site attention alarm reset pushbutton	atnlacknowledge	Not Pressed	Pressed		DI12		
13	Spare	-	-	-		DI13		
14	Spare	-	-	-		DI14		
15	Site Power	stnlmainsPower	Off	On		DI15		Moved from PLC in ver 1.3

19/11/2004

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SP103 Heroes Ave Physical IO List Ver 1.3.xls MITS DI (16-31)

Brisbane Water

MITS MD3311 EA (Extended I-O) DIGITAL INPUTS (16-31)

SP103 Heroes Ave Sewage Pumping Station

I/O #	Description	MITS Tag	Off State	On State	Term. #	Wire #	Drawing #	Comment
16	Spare	-	-	-		DI16		
17	Spare	-	-	-		DI17		
18	Spare	-	-	-		DI18		
19	Spare	-	-	-		DI19		
20	Spare	-	-	-		DI20		
21	Spare	-	-	-		DI21		
22	Spare	-	-	-		DI22		
23	Spare	-	-	-		DI23		
24	Spare	-	-	-		DI24		
25	Spare	-	-	-		DI25		
26	Spare	-	-	-		DI26		
27	Spare	-	-	-		DI27		
28	RTU Power	RTUpower	Off	On ✓		DI28		
29	Surge Diverter Alarm	Stn1SurgeDivAlm	Healthy	Fault ✓		DI29		
30	Spare	-	-	-		DI30		
31	Spare	-	-	-		DI31		

15/11/2004. ✓ AW 18/11

☑

SP103 Heroes Ave Physical IO List Ver 1.3.xls MITS DI (32-47)

Brisbane Water

MITS MD3311 EA (Extended I-O) DIGITAL INPUTS (32-47)

SP103 Heroes Ave Sewage Pumping Station

I/O #	Description	MITS Tag	Off State	On State	Term. #	Wire #	Drawing #	Comment
32	Generator Fault	genltripped	Ok	Tripped ✓	*	DI32		
33	Generator Warning	genlwarning	Ok	Alarm ✓	*	DI33		
34	Generator Low Fuel	genllowFuel	Ok	Low ✓	*	DI34		
35	Generator Running	genlrunning	Stopped	Running ✓	*	DI35		
36	Generator Connected	genlconnected	Energex	Generator ✓	*	DI36		
37	Energex Power	energexPower	Available	Not Available ✓	✓	DI37		
38	Generator Security	genlsecurity	Unsecured	Secured ✓	*	DI38		
39	Generator CB Status	genllocCBTripped	Closed	Tripped ✓	*	DI39		
40	Generator Mode	genlauto	Auto	Not Auto ✓	*	DI40		
41	Generator On Site	genlonSite	False	True ✓	*	DI41		
42	Spare	-	-	-		DI42		
43	Security Alarm	???	Alarm	Healthy ✗	✗	DI43		NOT INSTALLED ?
44	Main Incomer CB Closed	???	Open	Closed ✗	✗	DI44		Needs to be re-wired
45	Battery System OK	???	Fault	Healthy ✓	✓	DI45		
46	Cathodic Protection Alarm Reset	???	Not Pressed	Pressed ✗	✗	DI46		NOT INSTALLED !!
47	Cathodic Protection Power	???	Off	On ✗	✗	DI47		NOT INSTALLED !!

* To terminals only (no generator @ fat)

[illegible] 15/4/2004

Brisbane City Council Confidential 28/10/2004 5 OF 18

SP103 Heroes Ave Physical IO List Ver 1.3.xls MITS DO (0-15)

Brisbane Water

MITS MD3311 EA (Extended I-O) DIGITAL OUTPUTS (0-15)

I/O #	Description	MITS Tag	Off State	On State	Term. #	Wire #	Drawing #	Comment
0	Spare	-	-	-		DO00		
1	Spare	-	-	-		DO01		
2	Spare	-	-	-		DO02		
3	Spare	-	-	-		DO03		
4	Spare	-	-	-		DO04		
5	Spare	-	-	-		DO05		
6	Spare	-	-	-		DO06		
7	Spare	-	-	-		DO07		
8	Generator Remote Start	genlstart	Off	On ✓		DO08		
9	Generator Remote Stop	genlstop	Off	On ✓		DO09		
10	Spare	-	-	-		DO10		
11	Wet Well Washer Solenoid	WwllWasher	Off	On X	X	DO11		Test on Site.
12	Attention alarm Indicator	atnlindicator	Off	Alarm ✓		DO12		
13	Battery Check	BattCycRelay	Off	On ✓		DO13		
14	Cathodic Protection Alarm Indicator	cplAlarm	Off	Alarm X		DO14		NOT INSTALLED
15	Cathodic Protection De-energise Rectifier Unit	cplDeEnergise	Energise	De-Energise X		DO15		NOT INSTALLED

15/11/2004 / AW 18/11

Brisbane City Council Confidential 28/10/2004 6 OF 18

SP103 Heroes Ave Physical IO List Ver 1.3.xls MITS AI (0-7)

Brisbane Water

MITS MD3311 EA (Extended I-O) ANALOG INPUTS (0-7)

SP103 Heroes Ave Sewage Pumping Station

I/O #	Description	MITS Tag	4mA	20mA	Term. #	Wire #	Drawing #	Comment
0	Cathodic Protection Rectifier Current	cplRectCurrent	Site Specific	Site Specific		AI00 +/-		
1	Wet Well Level	wwllevel	0.000 m	8.000 m		AI01 +/-		
2		-	-	-		AI02 +/-		
3		-	-	-		AI03 +/-		
4		-	-	-		AI04 +/-		
5		-	-	-		AI05 +/-		
6		-	-	-		AI06 +/-		
7		-	-	-		AI07 +/-		

Test on Site.

Brisbane City Council Confidential 28/10/2004 7 OF 18

Brisbane Water

MITS MD3311 EA (Extended I-O) ANALOG OUTPUTS (0-3)

SP103 Heroes Ave Sewage Pumping Station

I/O #	Description	MITS Tag	4mA	20mA	Term. #	Wire #	Drawing #	Comment
0	Spare	-	-	-				
1	Spare	-	-	-				
2	Spare	-	-	-				
3	Spare	-	-	-				

Prepared by Alex Witthoft 28/10/2004

Brisbane Water

SP103 Heroes Ave Sewage Pumping Station

GE FANUC

RACK: 0
Slot: 2
Card Type: IC693CMM311
Description: MODBUS COMMS

GE-Fanuc 90-30 PACK 0

Settings	RTU Only

Port 1 RS232 TO MITS MD3311

RTU Enable	YES
Data Rate	19200
Flow Control	No
Parity	1
Station Address	1

Port 2 RS485 TO MITS MD3311

RTU Enable	YES
Interface	RS485
Data Rate	19200
Flow Control	No
Parity	1
Station Address	1

✓ AW 18/4

Prepared by Alex Witthoft 28/10/2004

Brisbane Water

GE-Fanuc 90-30 PACK 0

SP103 Heroes Ave Sewage Pumping Station

GE FANUC

RACK: 0
Slot: 3
Card Type: IC693MDL645
Description: 16 Point Digital Input 24VDC

I/O #	Term. #	Description	GE Tag	Address	Off State	On State	Term. #	Wire #	Drawing #	Comment
1	2	Station Local remote switch.	Stn01diRemote	%I0001	Local	Remote ✓		DI1-01		
2	3	Station Surcharge Imminent level	Stn01diSurchImm	%I0002	Healthy	Surcharge Imm ✓		DI1-02		
3	4	~~Station Mains power~~	~~Stn01diSitePower~~	%I0003	Off	On ✗		DI1-03		MOVED to RTU in ver 1.3
4	5	Sump Pump Fault	Smp01diFault	%I0004	Healthy	Fault ✓		DI1-04		
5	6	Sump Pump Running	Smp01diRunning	%I0005	Off	Running ✓		DI1-05		
6	7	Dry Well Flooded Alarm	Stn01diDryWellFloodedAl	%I0006	Healthy	Alarm ✓		DI1-06		
7	8	Dry Well Flooded Interlock	Stn01diDryWellFloodedTr	%I0007	Healthy	Interlock ✓		DI1-07		
8	9	Spare	%I0008	%I0008	-	-		DI1-08		
9	10	Spare	%I0009	%I0009	-	-		DI1-09		
10	11	Spare	%I0010	%I0010	-	-		DI1-10		
11	12	Spare	%I0011	%I0011	-	-		DI1-11		
12	13	Spare	%I0012	%I0012	-	-		DI1-12		
13	14	Spare	%I0013	%I0013	-	-		DI1-13		
14	15	Spare	%I0014	%I0014	-	-		DI1-14		
15	16	Spare	%I0015	%I0015	-	-		DI1-15		
16	17	Spare	%I0016	%I0016	-	-		DI1-16		

AWitthoft 15/11/04

AWitthoft 18/11

☑

Prepared by Alex Witthoft 28/10/2004

Brisbane Water

GE-Fanuc 90-30 PACK 0

GE FANUC

SP103 Heroes Ave Sewage Pumping Station

RACK: 0
Slot: 4
Card Type: IC693MDL645
Description: 16 Point Digital Input 24VDC

I/O #	Term. #	Description	GE Tag	Address	Off State	On State	Term. #	Wire #	Drawing #	Comment
1	2	Pump 1 Pump power on	Pmp01diPower	%I0017	Off	On ✓	✓	DI2-01		
2	3	Pump 1 Reflux Valve Open	Pmp01diRefluxOpen	%I0018	Not Open	Open ✓	*	DI2-02		
3	4	Pump 1 Local start pushbutton	Pmp01diLocalStartPB	%I0019	Not Pressed	Pressed ✓	✓	DI2-03		
4	5	Pump 1 Local stop pushbutton	Pmp01diLocalStopPB	%I0020	Not Pressed	Pressed ✓	✓	DI2-04		
5	6	Pump 1 Emergency Stop	Pmp01diEStop	%I0021	Fault	Healthy ✓	✓	DI2-05		
6	7	Pump 1 VFD Auto	Pmp01diVFDAuto	%I0022	Manual	Auto ✓	✓	DI2-06		
7	8	Pump 1 VFD Ready	Pmp01diVFDReady	%I0023	Fault	Ready ✓	✓	DI2-07		
8	9	Pump 1 local reset pushbutton	Pmp01diLocalReset	%I0024	Not Pressed	Pressed ✓	✓	DI2-08		
9	10	Pump 1 Running	Pmp01diRunning	%I0025	Not Running	Running ✓	✓	DI2-09		
10	11	Pump 1 Moisture in Oil	Pmp01diMIO	%I0026	Healthy	Fault ✓	✓	DI2-10		
~~11~~	~~12~~	~~Pump 1 Thermistor Fault~~	~~Pmp01diTermistor~~	~~%I0027~~	~~???~~	~~???~~		DI2-11		
~~12~~	~~13~~	~~Pump 1 Bearing Temperature~~	~~Pmp01diBearingTemp~~	~~%I0028~~	~~???~~	~~???~~		DI2-12		
13	14	Spare	%I0029	%I0029	-	-		DI2-13		
14	15	Spare	%I0030	%I0030	-	-		DI2-14		
15	16	Spare	%I0031	%I0031	-	-		DI2-15		
16	17	Spare	%I0032	%I0032	-	-		DI2-16		

* Terminal only - need to test.

* Pump 1 & 3 were swapped 17/11/04 ∴ re-tested.

AWitthoft 15/11/04

AWitthoft 19/11/04

Prepared by Alex Witthoft

28/10/2004

Brisbane Water

GE-Fanuc 90-30 PACK 0

GE FANUC

SP103 Heroes Ave Sewage Pumping Station

RACK: 0
Slot: 5
Card Type: IC693MDL645
Description: 16 Point Digital Input 24VDC

I/O #	Term. #	Description	GE Tag	Address	Off State	On State		Term. #	Wire #	Drawing #	Comment
1	2	Pump 2 Pump power on	Pmp02diPower	%I0033	Off	On	✓	✓	DI3-01		
2	3	Pump 2 Reflux Valve Open	Pmp02diRefluxOpen	%I0034	Not Open	Open	✓	✓	DI3-02		
3	4	Pump 2 Local start pushbutton	Pmp02diLocalStartPB	%I0035	Not Pressed	Pressed	✓	✓	DI3-03		
4	5	Pump 2 Local stop pushbutton	Pmp02diLocalStopPB	%I0036	Not Pressed	Pressed	✓	✓	DI3-04		
5	6	Pump 2 Emergency Stop	Pmp02diEStop	%I0037	Fault	Healthy	✓	✓	DI3-05		
6	7	Pump 2 VFD Auto	Pmp02diVFDAuto	%I0038	Manual	Auto		✓	DI3-06		
7	8	Pump 2 VFD Ready	Pmp02diVFDReady	%I0039	Fault	Ready		✓	DI3-07		
8	9	Pump 2 local reset pushbutton	Pmp02diLocalReset	%I0040	Not Pressed	Pressed	✓	✓	DI3-08		
9	10	Pump 2 Running	Pmp02diRunning	%I0041	Not Running	Running		✓	DI3-09		
10	11	Pump 2 Moisture in Oil	Pmp02diMIO	%I0042	Healthy	Fault	✓	✓	DI3-10		
~~11~~	~~12~~	~~Pump 2 Thermistor Fault~~	~~Pmp02diTermistor~~	~~%I0043~~	~~???~~	~~???~~			DI3-11		
~~12~~	~~13~~	~~Pump 2 Bearing Temperature~~	~~Pmp02diBearingTemp~~	~~%I0044~~	~~???~~	~~???~~			DI3-12		
13	14	Spare	%I0045	%I0045	-	-			DI3-13		
14	15	Spare	%I0046	%I0046	-	-			DI3-14		
15	16	Spare	%I0047	%I0047	-	-			DI3-15		
16	17	Spare	%I0048	%I0048	-	-			DI3-16		

Red 15/11

Green 18/11/04.

SP103 Heroes Ave Physical IO List Ver 1.3.xls

R0S5

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Prepared by Alex Witthoft 28/10/2004

Brisbane Water

GE-Fanuc 90-30 PACK 0

GE FANUC

SP103 Heroes Ave Sewage Pumping Station

RACK: 0
Slot: 6
Card Type: IC693MDL645
Description: 16 Point Digital Input 24VDC

I/O #	Term. #	Description	GE Tag	Address	Off State	On State		Term. #	Wire #	Drawing #	Comment
1	2	Pump 3 Pump power on	Pmp03diPower	%I0049	Off	On		✓	DI4-01		
2	3	Pump 3 Reflux Valve Open	Pmp03diRefluxOpen	%I0050	Not Open	Open		✓	DI4-02		
3	4	Pump 3 Local start pushbutton	Pmp03diLocalStartPB	%I0051	Not Pressed	Pressed		✓	DI4-03		
4	5	Pump 3 Local stop pushbutton	Pmp03diLocalStopPB	%I0052	Not Pressed	Pressed		✓	DI4-04		
5	6	Pump 3 Emergency Stop	Pmp03diEStop	%I0053	Fault	Healthy		✓	DI4-05		
6	7	Pump 3 VFD Auto	Pmp03diVFDAuto	%I0054	Manual	Auto		✓	DI4-06		
7	8	Pump 3 VFD Ready	Pmp03diVFDReady	%I0055	Fault	Ready		✓	DI4-07		
8	9	Pump 3 local reset pushbutton	Pmp03diLocalReset	%I0056	Not Pressed	Pressed		✓	DI4-08		
9	10	Pump 3 Running	Pmp03diRunning	%I0057	Not Running	Running		✓	DI4-09		
10	11	Pump 3 Moisture in Oil	Pmp03diMIO	%I0058	Healthy	Fault		✓	DI4-10		
~~11~~	~~12~~	~~Pump 3 Thermistor Fault~~	~~Pmp03diTermistor~~	~~%I0059~~	~~???~~	~~???~~			DI4-11		
~~12~~	~~13~~	~~Pump 3 Bearing Temperature~~	~~Pmp00diBearingTemp~~	~~%I0060~~	~~???~~	~~???~~			DI4-12		
13	14	Spare	%I0045	%I0061	-	-			DI4-13		
14	15	Spare	%I0046	%I0062	-	-			DI4-14		
15	16	Spare	%I0047	%I0063	-	-			DI4-15		
16	17	Spare	%I0048	%I0064	-	-			DI4-16		

* Pump 1+3 were swapped 17/11/04
∴ re-tested.

Red. 15/11
Green 18/11/04

AWitthoft

SP103 Heroes Ave Physical IO List Ver 1.3.xls R0S6 13 of 18

Prepared by Alex Witthoft 28/10/2004

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SP103 Heroes Ave Sewage Pumping Station

GE FANUC

GE-Fanuc 90-30 PACK 0

RACK: 0
Slot: 7
Card Type: IC693MLD940
Description: 16 Point Ditital relay Output 2A

I/O #	Term. #	Description	GE Tag	Address	Off State	On State	Term. #	Wire #	Drawing #	Comment
1	2	Pump 1 Status Indicator	Pmp01dqLamp	%Q0001	Off	On ✓	✓	DO1-01		
2	3	Pump 1 Run Command	Pmp01dqGo	%Q0002	Off	Run ✓	✓	DO1-02		
3	4	Pump 1 Fault Reset	Pmp01dqReset	%Q0003	Off	Reset ✓	✓	DO1-03	→ VFD	Program ?? ✓
4	5	Pump 1 Run at Maximum Speed	Pmp01dqRunMax	%Q0004	Off	Maximum Speed ✓	✓	DO1-04		
5	7	Pump 2 Status Indicator	Pmp02dqLamp	%Q0005	Off	On ✓	✓	DO1-05		
6	8	Pump 2 Run Command	Pmp02dqGo	%Q0006	Off	Run ✓	✓	DO1-06		
7	9	Pump 2 Fault Reset	Pmp02dqReset	%Q0007	Off	Reset ✓	✓	DO1-07	→ VF	D Programm ?? ✓
8	10	Pump 2 Run at Maximum Speed	Pmp02dqRunMax	%Q0008	Off	Maximum Speed ✓	✓	DO1-08		
9	12	Pump 3 Status Indicator	Pmp03dqLamp	%Q0009	Off	On ✓	✓	DO1-09		
10	13	Pump 3 Run Command	Pmp03dqGo	%Q0010	Off	Run ✓	✓	DO1-10		
11	14	Pump 3 Fault Reset	Pmp03dqReset	%Q0011	Off	Reset ✓	✓	DO1-11	→ VFD	Program ?? ✓
12	15	Pump 3 Run at Maximum Speed	Pmp03dqRunMax	%Q0012	Off	Maximum Speed ✓	✓	DO1-12		
13	17	Spare	%Q0013	%Q0013	-	-		DO1-13		
14	18	Spare	%Q0014	%Q0014	-	-		DO1-14		
15	19	Spare	%Q0015	%Q0015	-	-		DO1-15		
16	20	Spare	%Q0016	%Q0016	-	-		DO1-16		

AWitthoft 15/11/2004.

☑

SP103 Heroes Ave Physical IO List Ver 1.3.xls R0S7 14 of 18

Prepared by Alex Witthoft

28/10/2004

Brisbane Water

GE-Fanuc 90-30 PACK 0

GE FANUC

SP103 Heroes Ave Sewage Pumping Station

RACK: 0
Slot: 8
Card Type: IC693ALG221
Description: 4 Channel Analog Input Current (Isolated)

I/O #	Term. #	Description	GE Tag	Address	4mA	20mA	Term. #	Wire #	Drawing #	Comment
1	3,5	Wet Well Level	Wwl01aiRaw	%AI001	0.000 m	8.000 m		AI1-01P		
2	4,6	Delivery Pressure	Pre01aiRaw	%AI002	0.00 m	50.000 m		AI1-02P		
3	13,15	Delivery Flow	Flw01aiRaw	%AI003	0.0 l/s	300.00 l/s		AI1-03P		
4	14,16	Spare	%AI004	%AI004	-	-		AI1-04P		

External to Board
Test on Site -

19/11/04

SP103 Heroes Ave Physical IO List Ver 1.3.xls

R0S8

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Prepared by Alex Witthoft 28/10/2004

Brisbane Water

GE-Fanuc 90-30 PACK 0

GE FANUC

SP103 Heroes Ave Sewage Pumping Station

RACK: 0
Slot: 9
Card Type: IC693ALG221
Description: 4 Channel Analog Input Current (Isolated)

I/O #	Term. #	Description	GE Tag	Address	4mA	20mA	Term. #	Wire #	Drawing #	Comment
1	3,5	Pump 1 VFD Running Speed	Pmp01SpeedFbk	%AI005	0.0%	100%	✓	AI2-01P		
2	4,6	Pump 2 VFD Running Speed	Pmp02SpeedFbk	%AI006	0.0%	100%	✓	AI2-02P		
3	13,15	Pump 3 VFD Running Speed	Pmp03SpeedFbk	%AI007	0.0%	100%	✓	AI2-03P		Added Pump 3 in Ver 1.0
4	14,16			%AI008				AI2-04P		

✓

Prepared by Alex Witthoft 28/10/2004

Brisbane Water

GE-Fanuc 90-30 PACK 0

GE FANUC

SP103 Heroes Ave Sewage Pumping Station

RACK: 0
Slot: 10
Card Type: IC693ALG392
Description: 8 Channel Analog Output Current

I/O #	Term. #	Description	GE Tag	Address	4mA	20mA	Term. #	Wire #	Drawing #	Comment
1		Pump No.1 Speed Command	Pmp01aqControlSpeed	%AQ001	0%	100%		AO1-01P		
2		Pump No.2 Speed Command	Pmp02aqControlSpeed	%AQ002	0%	100%		AO1-02P		
3		Pump No.3 Speed Command	Pmp03aqControlSpeed	%AQ003	0%	100%		AO1-03P		Added Pump 3 in Ver 1.0
4				%AQ004				AO1-04P		
5				%AQ005				AO1-05P		
6				%AQ006				AO1-06P		
7				%AQ007				AO1-07P		
8				%AQ008				AO1-08P		

SP103 Heroes Ave Physical IO List Ver 1.3.xls MODBUS

Brisbane Water

MITS MD3311 EA (Extended I-O) MODBUS INPUTS

SP103 Heroes Ave Sewage Pumping Station

Drop	Description	MITS Tag	Modbus Address					Comment
1	Pump 1 Motor Power high Word		30003	✓				
1	Pump 1 Motor Power low Word		30004	✓				
1	Pump 1 Motor Current		30019	✓				
1								
2	Pump 2 Motor Power high Word		30003	✓				
2	Pump 2 Motor Power low Word		30004	✓				
2	Pump 2 Motor Current		30019	✓				
2								
3	Pump 3 Motor Power high Word		30003	✓				
3	Pump 3 Motor Power low Word		30004	✓				
3	Pump 3 Motor Current		30019	✓				
3								

✓

Brisbane City

Brisbane Water

BRISBANE WATER

Network Control Systems

FACTORY ACCEPTANCE TEST (FAT)
TEST DOCUMENT

SPSV3 - Sewage Pumping Station
Submersible 3 Pumps With VSD

Project & Commissioning Details

Date Commissioned	15, 18 & 19th Nov 2011
Project Manager	Stuart Hitchcock
Construction Manager	
Electrical Inspector	Peter Pennex
RTU Programmer (NCS)	Alex Wittholft & Geoff Timms
Electricians	MPA – Karen

FAT TEST (FOR ELECTRICAL INSPECTOR)

SP: 103

LOCATION: Heroes Ave

This check list is to be performed before the official IDTS commissioning of the sewerage pump station.

CABINET

Task	Outcome
Check that locks are fitted on all doors and keyed correctly.	OK ☒ On site
Check that the Power Supply and RTU have their lights visible	OK ☑
The heat shield are to be attached via welding NOT drilling throught the board.	OK ☒ N/A
Drawing Sheet pouch to be attached on the RTU cubicle door	OK ☑
90mm gap above and below the RTU (to allow for cables from laptop to be plugged into the ports)	OK ☑
Gland plate in the PLC cubicle (cables such as aerial, phone line, surcharge imminent electrode).	OK ☑
Check that the limit switch works and turns off when the doors are closed.	OK ☒ N/A
Check that Energex meter lock is fitted on the meter box.	OK ☒ On site
Perform a physical inspection of the site and switchboard to determine if it is safe. Note any defect on the Defect notification sheet. Note any defects in switchboard.**(On Defect Sheet)** __________ __________ __________	Pass ☐ Fail ☐

POINT TO POINT

Task	Outcome
Using the Electrical Drawing do a thorogh point to point on the control circuit to ensute that the local control of the pump operates independantly of the RTU. Wired to the RTU from beginning to end. (ie press the actual button and watch the I-O change in Isagraf). The Drawings should be marked up with any changes to provide the AS BUILT markups (in conjuction with any modifications made during Site Acceptance Testing). (All circuits shoud be 'highlighted' as they are checked.	OK ☑

VARIABLE SPEED DRIVE

Task	Outcome
Check that the motor starter is programmed and able to start the each pump	Pmp1-OK☑ Pmp2-OK☑ Pmp3-OK☑
Check that each VSD modbus connection active and that the Power and Current are being read corretly and are scalled correctly.	Pmp1-OK☑ Pmp2-OK☑ Pmp3-OK☑

Site pre-commissioned by (Electrical Inspector)

Name: Peter Rennie

Signature: NOT ON SITE *

Date: 18/11/04

Pre-commissioning Test Sheet checked by NCS Project Officer

Name: Geoff Timms

Signature: ....

Date: 18/11/04

* USED SEPERATE TEST SHEET FOR ELECTRICAL INSPECTION. THIS IS NOT THE OFFICIAL TEST ONLY A CHECKLIST

FAT TEST (RTU PROGRAMMER)

SP: 103

LOCATION: Heroes Ave

RTU

Task	Outcome GD
Check that the RTU has the correct IP address set	IP Address 192 . 168 . 35 . 89 Subnet mask 255 . 255 . 255 . 0
Check that the RTU has the correct program code loaded	Code Name SP103-
Check CPU Firmware Version and Serial Number	Serial Number 0103-8999 Firmware Ver 1.0.4.
Check that the .main file has been downloaded from the IDTS	OK ☑

POINT TO POINT

Task	Outcome
Using the Physical I-O Spreadsheeet check each individual physical I-O Wired to the RTU from beginning to end. (ie press the actual button and watch the I-O change in Isagraf). The I-O spreadsheet should be ticked and signed by the test and attached to this FAT Test Document.	OK ☑

BATTERY

Task	Outcome
Check that the battery is connected and charging (i.e. 24V across the terminals).	OK ☑
Check that the RTU is running off battery when the mains supply is isolated	OK ☑

RADIO

Task	Outcome
Check that the correct radio type has been installed - high or low (transmit frequency)	High ☐ Low ☑
Check that radio is set on the correct frequency for the desired base station.	Tx MHz Rx MHz X Base Station: TO DO DURING PRE-COMM

Site FAT by (RTU Programmer)	Pre-commissioning Test Sheet checked by NCS Project Officer
Name: Alex Witthoft	Name: Geoff Tims
Signature: AWitthoft	Signature:
Date: 18/11/04	Date: 18/11/04

Brisbane City

Brisbane Water

BRISBANE WATER

Network Control Systems

PRE-COMMISSIONING ACCEPTANCE TEST DOCUMENT

SPSV3 - Sewage Pumping Station Submersible 3 Pumps With VFD

SP : 103

Location : Heroes Ave.

Project & Commissioning Details

Date Commissioned	20-7-2005
Project Manager	Andy Moore
Construction Manager	Mike Heritage. / Reg McGuire.
Electrical Inspector	Mike Tomlinson.
RTU Programmer (NCS)	Alex Witthoft.
Electricians	SJ's + HVAC

SITE ACCEPTANCE TEST - SECURITY AND COMMUNICATIONS

CABINET

Task	Outcome
Check that locks are fitted on all doors and keyed correctly.	OK ☑

NORTH SURVEY MARKER

Task	Outcome
Confirm the North Survey Marker Number	N/A
Confirm the North Survey Marker Elevation	N/A mAHD

Not surveying done Board upgrade

ANTENNA

Task	Outcome
Check that the antenna mast (pole) has adequate clearance from overhead power lines. ▪ 1.8 metres for LV line ▪ 3 metres for HV line ▪ Antenna should NOT be mounted vertically beneath a power line.	From LV > 1.8m OK ☑ From HV > 3.0m OK ☑
Check that the antenna is mounted with the drain hole in the dipole facing towards the ground.	OK ☑
Check that antenna is pointing in the correct direction. (Bearing the same as the Radio Survey result)	OK ☑
Check the VSWR of the cable with the antenna connected. Done by radio workshops.	_____VSWR

RADIO

Task	Outcome
Radio Serial number	Serial Number 3931
Check that the correct radio type has been installed – high or low (transmit frequency)	High ☐ Low ☑
Check that radio is set on the correct frequency for the desired base station. Mt Coot-tha	Tx 853.625MHz Rx MHz
Check that the RSSI is similar to the signal strength obtained in the Radio Survey results.	RSSI -67 dB
Check that the (BER) packet test is similar to the Radio Survey. Packet Loss loss with 10 dB attenuation	Loss ________ %
Port B setup to be Diags Port (SID 0) or Peer Comms (SID 41) ?	Diags ☑ Peer ☐

Tx Pwr 1127

DRAWINGS

Task	Outcome
AS BUILT drawing Set on site.	OK ☑

Site pre-commissioned by	Test Sheet checked by NCS Project Officer
Name: Geoff Timms	Name: Alex Willett
Signature:	Signature: [signature]
Date:	Date: 12/08/2005

SITE ACCEPTANCE TEST – PRE COMMISSIONING CHECKLIST

RTU

Task	Outcome
Check that the RTU has the correct IP address set	IP Address 192.168.35.90 Subnet mask 255.255.255.0
Check that the RTU has the correct program code loaded	Code Name
Check CPU Firmware Version and Serial Number	Serial Number 0103-8999 Firmware Ver 1.04
Check that the rtu database has been downloaded from the IDTS	OK ☐
Check that the RTU database address is correct and the same as the MD3311 address	rtu1address 90

BATTERY

Task	Outcome
Check that the battery is connected and charging (i.e. 24V across the terminals).	OK ☑
Check that the RTU is running off battery when the mains supply is isolated	OK ☑

SURCHARGE IMMINENT PROBE

Task	Outcome
Check that the surcharge imminent probe is fixed at the correct height and is operational. (Actually ground the electrode to ensure full ponit to point)	OK ☑

WET WELL PROBE

(AW). 08-12 August.

Task	Outcome
Check that the range of the Vega is the same as the value in the RTU initialisation block.	Range 8 m
Check that the suspended length of the Vega matches the "zero" value (4mA) in the RTU initialisation block.	Zero -4.869 m
Look at the Pump Station switchboard plaque and confirm that the % values for • Duty A start • Duty A stop • Surcharge imminent • Surcharge occurring match the RTU settings and are valid for the site.	A Start 32 % A Stop 5 % Sur Im 0.171 % m AHD Sur Oc 0.471 % m AHD

Site pre-commissioned by (RTU Programmer)

Name: Geoff Timms

Signature:

Date:

Test Sheet checked by NCS Project Officer

Name: Alex Whitloft

Signature: AWhitloft

Date: 12-09-2005

PRESSURE GAUGE AW

Task	Outcome
Calibrate the Pressure gauge.	OK ☐
Check that the range of the pressure gauge is the same as the value in the RTU initialisation block.	Range 100 m
Check that the surveyed height of the pressure gauge matches the "zero" value (4mA) in the RTU initialisation block.	Elev T.R.A mAHD
Low and High alarms have a default value of Elev and Elev + Range	OK ☑

FLOW METER AW

Calibrate the Flowmeter.	OK ☑
Check that the range of the Flowmeter is the same as the value in the RTU initialisation block.	Range 300 l/s
Check the minimum value is setup correcty (usually 0 l/s)	Min 0 l/s
Low and High alarms have a default value of 0 and Range	OK ☑

PUMPS AW

Task	Outcome
Bleed the pumps to remove any air in the impeller housing	OK ☑
Check the motor current and determine whether it is "correct" for the size of pump. • Low current may indicate air in the pump or blocked pump. • A high current may indicate a rag jam in the pump impeller.	Pump 1 - OK ☑ Pump 2 - OK ☑ Pump 3 - OK ☑
Check that the pumps are running in the correct rotation direction by observing the torque reaction movement of the pump casing when pump starts (submersible pumps).	Pump 1 - OK ☑ Pump 2 - OK ☑ Pump 3 - OK ☑
Check that the each pump can develop the desired pressure in the raising main.	Pump 1 - OK ☑ Pump 2 - OK ☑ Pump 3 - OK ☑

MOTOR STARTER

Task	Outcome
Check that the motor starter is programmed and able to start the each pump	Pump 1 - OK ☑ Pump 2 - OK ☑ Pump 3 - OK ☑

Site pre-commissioned by (Electrical Inspector)

Name: Geoff Time

Signature: ....

Date: ....

Pre-commissioning Test Sheet checked by NCS Project Officer

Name: Alex Withoff

Signature: AWithoff

Date: 12-08-05

Brisbane City

Brisbane Water

BRISBANE WATER

Network Control Systems

SITE ACCEPTANCE TEST (SAT)
TEST DOCUMENT (On Site)

SPSV3 - Sewage Pumping Station
3 Pumps With VFD

SP : 103

Location : Heroes Ave.

Project & Commissioning Details

Date Commissioned	
Project Manager	
Construction Manager	
Electrical Inspector	
RTU Programmer	
Electricians	

FIELD DEVICES

All the I/O internal to the switchboard should have been tested during the factory test. Confirm that the Factory test sheet has been completed and all I/O has been tested to the terminal strip. The following tests will prove the field devices that have been installed on site and that they are operating correctly.

SURCHARGE IMMINENT

Action	Observation	Result
Trigger the Surcharge Imminent Probe	Ensure that the relay activates (and a 0 is sent to the RTU). The relay is fail safe (normally closed when healthy).	☑ OK
Reset the Surch Imm Probe	Ensure that the realy deactivates (and 1 is sent to the RTU)	☑ OK

AW 20/7

ANALOG SIGNALS

Action	Observation	Result
Vega Probe	Ensure the device is ranged in the code exactly the same as the device Ensure that the signal is reading correctly	☑ OK
Flow Meter	Ensure the device is ranged in the code exactly the same as the device Ensure that the signal is reading correctly	☑ OK
Pressure Gauge	Ensure the device is ranged in the code exactly the same as the device Ensure that the signal is reading correctly	☑ OK

AW 9/8

SUMP PUMP (IF PRESENT)

Action	Observation	Result
With the level between the start and stop electorode.	Sump Pump is Off Running indication lamp is off	☑ OK ☑ OK
Start the sump pump using the start push button	Sump Pump Runs Running indication lamp is active	☑ OK ☑ OK
Press the sump pump stop button	Sump Pump is Off Running indication lamp is off	☑ OK ☑ OK
Fill the sump level to above the start level	Ensure that the sump pump starts at the correct level (ie top lip of the sump).	☑ OK
Allow the sump pump to empty the sump.	Ensure that the sump pump stops at the correct level (ie at the bottom of the sump – and that the sump pump does note keep running or air lock)	☑ OK
Trigger the high level electrode in the sump	Ensure the digital input is activated	☑ OK
Trigger the trip level electrode in the sump	Ensure the digital input is activated En sure that this signal interlocks the sewer pumps from running.	☑ OK ☑ OK
IDTS Points Check the following points to IDTS	Sump Pump Running Sump Pump Fault Sump Pump Excessive Cycling Sump Pump Excessive Run Sump High Level Sump Trip Level	☑ OK ☑ OK ☑ OK ☑ OK ☑ OK ☑ OK ☑ OK

AW 20/7
AW 20/7
AW 20/7
AW 9/8
AW 9/8
AW 10/8
AW 14/8

FIELD EMERGENCY STOP (IF PRESENT)

Action	Observation	Result
Trigger the Field E/Stop	Ensure that the E/Stop input deactivates (Fault)	☑1 ☑2 ☑3
Reset the Field E/Stop	Ensure that the E/Stop input activates (Healthy)	☑1 ☑2 ☑3

AW 20/7

REFLUX VALVES (IF PRESENT)

Action	Observation	Result
Open the reflux valve	Ensure that the signal is active	☑1 ☑2 ☑3
Close the reflux valve	Ensure that the signal is off	☑1 ☑2 ☑3
IDTS Points	Reflux Fail to Close	☑1 ☑2 ☑3
	Reflux Fail to Open	☑1 ☑2 ☑3
Check the following	Reflux Fail to Open Count Exceeded	☑1 ☑2 ☑3
points to IDTS	Reflux Fail to Open Auto Reset	☑1 ☑2 ☑3

AW 20/7

AW 10/8

WET WELL WASHER (IF PRESENT)

Action	Observation	Result
Trigger the Wet Well Washer (Code)	Ensure that the Solenoid opens	☑OK
Reset the Wet Well Washer (Code)	Ensure that the Solenoid closes	☑OK

AW 10/8

THERMISTOR (IF PRESENT)

Action	Observation	Result
Run the pump and open circuit the thermistor	Ensure that the VFD trips on Thermistor fault and stops the pump	☑1 ☑2 ☑3
Close the thermistor circuit and reset the VFD	Ensure that the VFD is healthy and can run the pump	☑1 ☑2 ☑3

AW 10/8

MOISTURE IN OIL (IF PRESENT)

Action	Observation	Result
Run the pump and simulate a moisture in oil fault.	Ensure that the pump trips on Moisture in oil fault	☑1 ☑2 ☑3
Reset the moisture in oil fault input and reset the pump	Ensure that the pump is healthy and can run the pump	☑1 ☑2 ☑3

AW 14/8

IDTS COMMISSIONING TEST SHEET

The purpose of these tests is to confirm that the new RTU is running and responding to inputs and sending data back to the IDTS master station.

- Notify Control Room that site is being commissioned - ph 340 78414
- Contact IDTS Test Room ph 3407 8477 to confirm receipt of alarms

IDTS COMMISSIONING TEST SHEET

Action	Observation	Result
Site in remote mode Switch on RTU power	Confirm that RTU ABNORMAL OPERATION alarm is received by IDTS Confirm that operator ajustable alarm setpoints are downloaded on RTU restart.	☑ Yes ☑ Yes
Cycle the mains power	Confirm that SITE POWER MAINS FAIL alarm is received by IDTS and no other alarms [alarm suppression] are sent	☑ Yes
Switch off RTU mains power	Confirm that RTU MAINS FAIL alarm is received by IDTS	☑ Yes
Test operation of all pumps in REMOTE mode (Manual)	Each pump starts and stops when commanded by the IDTS picture controls	☑ 1 ☑ 2 ☑ 3
Activate the probe itself to produce the surcharge imminent alarm.	Confirm that 2 pumps start	☑ Yes
	Confirm that SURCHARGE IMMINENT alarm is received by IDTS	☑ Yes
Switch site to LOCAL and STOP pumps Wait until surcharge pumping timer expires (Record Time)	Confirm that LOCAL mode alarm is received by IDTS	☑ Yes
Test operation of all pumps in LOCAL mode	Each pump starts and stops when commanded by the site pushbuttons	☑ 1 ☑ 2 ☑ 3
Site in Remote mode, RTU operating Test operation of the pump inhibit	Apply pump inhibit to each pump and confirm that "station inhibit" is active	☑ 1 ☑ 2 ☑ 3
Fault Pump 1 *Note: not every point that causes an availability alarm is tested, as this linkage is proved by SPSS2 standard code and FAT of switchboard*	Confirm Availability alarm is received by IDTS. Look at the points page and confirm the reason for the fault. Send a remote reset to clear the fault	☑ OK ☑ OK ☑ OK
Fault Pump 2	Confirm Availability alarm is received by IDTS. Look at the points page and confirm the reason for the fault. Send a remte reset to clear the fault	☑ OK ☑ OK ☑ OK
Fault Pump 3	Confirm Availability alarm is received by IDTS. Look at the points page and confirm the reason for the fault. Send a remte reset to clear the fault	☑ OK ☑ OK ☑ OK
Trigger Wet Well Surcharge Occurring Alarm	Confirm alarm is received by IDTS	☑ OK
Trigger Wet Well High alarm	Confirm alarm is received by IDTS	☑ OK

UNCLEAR TEXT

Action	Observation	Result
Trigger Wet Well Invalid Alarm	Confirm alarm is received by IDTS	☑ OK
Allow well to fill.	Observe that the duty pump starts and stops. Only need to test for 1 pump on a slow filling site.	☑ Yes
	Confirm that IDTS is receiving the correct wet well level (%).	☑ Yes
Pump start and stop values shown on the wet well label match the IDTS picture	Surcharge Actual ____ % 0.470 mAHD Surcharge Imminent ____ % 0.170 mAHD Duty B Start ____ % -1.789 mAHD Duty B Stop ____ % -2.409 mAHD Duty A Start 32 % -3.209 mAHD Duty A Stop 5 % -4.469 mAHD Vega Length 8.5 m Vega Range 8.0 m Vega Zero -4.809 mAHD	

Site FAT by (RTU Programmer)

Name: Alex Withoff

Signature: [signature]

Date: 10/08/05

Pre-commissioning Test Sheet checked by NCS Project Officer

Name: PETER SHERRIFF

Signature: [signature]

Date: 15-08-05

PID TUNING

SP: 103

LOCATION: HEROES AVE

This test can only be carried out if the inflow to the station is greater than the flow that one pump produces at minimum speed. The tuning of the loops should be rechecked after a 24 hour period (on trending) to ensure the station operates correctly over the varying flows during the day.

LOOP 3 – WET WELL LEVEL → PUMP SPEED

Action	Observation	Result
Level reaches the Duty A start level	• Pump runs at minimum speed • Wet well will continue to rise	☑ Yes ☑ Yes
Level reaches the PID set point level and continues to rise	• Pump speed will increase in a controlled manner until the level starts to fall. • Over time the should drop to the PID set point.	☑ Yes
Level falls below the PID set point level	• Pump speed will reduce in an attempt to maintain the PID set point level.	☑ Yes
Check the trending of the site.	• Overall the pump speed should change in a controlled maner. • The wet well level should be fairly constant, around the PID set point. • Unless the inflow to the site is greater than the flow of one pump running at max speed, the station should only run one pump – the speed should change quickly enough to avoid the starting of the second pump.	☑ Yes
PID CONSTANTS RECORDED IN INIT BLOCK	• Once the PID loop has been tuned, all constants in the INIT block must be recorded (ie the init value should equal the current value) so that the loop is tuned on the code as well as the running program.	☑ Yes

Site FAT by (RTU Programmer)

Name: Alex Wittloff

Signature: [signature]

Date: 10/08/05

Pre-commissioning Test Sheet checked by NCS Project Officer

Name: PETER SHERRIFF

Signature: [signature]

Date: 15-08-05

LOOP 1 & 2 – CASCADED - WET WELL LEVEL → FLOW → PUMP SPEED

Action	Observation	Result
Level reaches the Duty A start level	• PID Loop 1 will request the minimum flow. • PID Loop 2 will run the pump at minimum speed and will increase the speed if the minimum flow is not achieved. (It should be close tho). • Wet well will continue to rise	☑ Yes ☑ Yes ☑ Yes
Level reaches the PID set point level and continues to rise	• PID Loop 1 will increase the flow set point. • PID Loop 2 will increase the pump speed to achieve the new flow SP. • The pump speed increases in a controlled manner, the level will eventually start to fall. • Over time the well level should drop to the PID set point.	☑ Yes ☑ Yes ☑ Yes ☑ Yes
Level falls below the PID set point level	• PID Loop 1 will decrease the flow set point. • PID Loop 2 will decrease the pump speed to achieve the new flow SP	☑ Yes ☑ Yes
Check the trending of the site.	• Overall the flow SP and the pump speed should change in a controlled maner. • The flow should be stable, with no large variations over a small time period. A steady increase/decrease is what is desired. • The wet well level should be fairly constant, around the PID set point. • Unless the inflow to the site is greater than the flow of one pump running at max speed, the station should only run one pump – the flow SP, and thus the speed, should change quickly enough to avoid the starting of the second pump. (Must be balaced with the previous condition)	☑ Yes ☑ Yes ☑ Yes ☑ Yes
PID CONSTANTS RECORDED IN INIT BLOCK	• Once the PID loop has been tuned, all constants in the INIT block must be recorded (ie the init value should equal the current value) so that the loop is tuned on the code as well as the running program.	☑ Yes

Site FAT by (RTU Programmer)

Name: Peter Hh[illegible]

Signature: [signature]

Date: 10/08/05

Pre-commissioning Test Sheet checked by NCS Project Officer

Name: PETER SHERRIFF

Signature: [signature]

Date: 15/09/05

Note: Printed copies of this document should be verified for currency against the published electronic copy.

Brisbane City

Brisbane Water

BRISBANE WATER

Network Control Systems

FACTORY + SITE

~~SITE~~ ACCEPTANCE TEST ~~(FAT)~~

TEST DOCUMENT

SP103 Heroes Avenue

Temporary Board Installation

Project & Commissioning Details

Date Commissioned	29/03/05
Project Manager	Andy Marie
Construction Manager	Reg McGuv & Mick Hembidge
Electrical Inspector	" "
RTU Programmer (NCS)	Alex + Geoff Timmins
Electricians	Grant Keer (HVAC)

SITE CONFIGURATION

This test ONLY tests the functionality of the HWT RTU in the Old Switchboard and its interaction with the Allen Bradley PLC in the Temporary Switchboard. It does NOT cover any testing of the Allen Bradley Code.

RTU

Check that the RTU has the correct program code loaded	Code Name SP103_36
Check CPU Firmware Version and Serial Number	Serial Number 3823 Firmware Ver N/A
Check that the DNP file has been downloaded to the RTU	File name SP103 Heroes Ave 20050322.HWT

TEMPORARY BOARD INSTRUMENTATION

Surcharge Imminent Probe

Task	Outcome
Check that the surcharge imminent probe is fixed at the correct height and is operational. (Actually ground the electrode to ensure full ponit to point). Also check that its suspended at the same height as the one in the old wet well	OK ☑

Wet well Probe

Task	Outcome
Calibrate the Vega probe. Ensure it is calibrated the same as the old switchboard Vega Probe	OK ☑
Check that the "deragging" tube is fitted over the Vega and covers the pump start and stop range.	OK ☐ No rag tube fitted

Brisbane Water – Networks Control Officer	HVAC Representative
Name: Geoff Timms	Name: William Wong
Signature: GT	Signature: WWong
Date: 29/3/5	Date: 29/03/05

PHYSICAL POINT TO POINT

THe followig IO is hard wired between the HWT RTU and the AB PLC.

TEST	ACTION	OBSERVATION	OUTCOMES
DIGITAL INPUTS			
POINT	*In the temporary Board..*	*In the RTU and in IDTS*	*RTU* ✓
Pump T1 Running	Run Pump 1	Ensure the RTU digital input activates	☑ ✓
Pump T2 Running	Run Pump 2	Ensure the RTU digital input activates	☑ ✓
Pump T3 Running	Run Pump 3	Ensure the RTU digital input activates	☑ ✓
Pump T4 Running	Run Pump 4	Ensure the RTU digital input activates	☑ ✓
Pump T1 Available	Make Pump 1 Unavailable	Ensure the RTU digital input activates	☑ ✓
Pump T2 Available	Make Pump 2 Unavailable	Ensure the RTU digital input activates	☑ ✓
Pump T3 Available	Make Pump 3 Unavailable	Ensure the RTU digital input activates	☑ ✓
Pump T4 Available	Make Pump 4 Unavailable	Ensure the RTU digital input activates	☐ ✓
Surcharge Imminent	Trigger the Surcharge Imm	Ensure the RTU digital input activates	☑ ✓
PLC Healthy	Fault the PLC	Ensure the RTU digital input activates	☑ ✓
Common Fault	Trigger the common fault	Ensure the RTU digital input activates	☑ ✓
DIGITAL OUTPUT			
POINT	*In the HWT RTU*	*In the AB PLC*	*PLC*
Station Interlock	Force the Station Interlock	Ensure the interlock is received Also ensure the interlock relay is activated. (to stop pumps running in multitrode control).	☑ ✓
Analog Input			
Wet Well Level	Ensure the well level for both well is the same level (ie above the inlet – so they are hydraulically linked)	Ensure that both well levels are the same (in mAHD). Raise the well level and ensure both well levels in the RTU increase at the same rate.	☑ ✓

Brisbane Water – Networks Control Officer

Name: G TIMMS

Signature: GT

Date: 29/3/5

HVAC Representative

Name: William Wong

Signature: [signature]

Date: 29/03/05

FUNCTIONALITY TESTING

STATION INTERLOCK

TEST	ACTION	OBSERVATION	OUTCOMES
INTERLOCK FUNCTION (Un-Inhibit)	Un-Inhibit on of the old pumps	The interlock for the temporary station will activate. Ensure that no pumps will run (in auto) on the temporary board (ie level rises above start level)	☑
	Re-inhibit all old pumps	Ensure that the temorary station is again allowed (and does) run pumps in auto	☑
INTERLOCK FUNCTION (Level > Inhibit Stop)	Fail all pumps on the temporary board. Well level will rise.	When level rises to 500mm below surcharge (stop inhibit level) 5 seconds later the station inhibit will ativate (interlocking the temp board) Then the old station will start the duty pump.	☑
	Make all pumps on the temp board available	When the "inhibit pumping mode" deactivates and the old station stops all pumps, the interlock will be released and the temp board should start lots of pumps (up to 3?)	☑
INTERLOCK FUNCTION (Surcharge Imminent)	Trigger the surcharge Imminent Probe on the OLD switchbaord and wait for surcharge pumping mode to activate.	The interlock for the temporary station will activate. Ensure that no pumps will run (in auto) on the temporary board (ie level rises above start level).	☑
	Wait until surcharge pumping mode is deactivated.	Ensure that the temorary station is again allowed (and does) run pumps in auto.	☑

—— - 0.025 Inh. Start.

4.~~75~~m on VFD.

Brisbane Water – Networks Control Officer

Name: G TIMMS

Signature: GT

Date: 29/3/5

HVAC Representative

Name: William Wong

Signature: [illegible]

Date: 29/03/05

IDTS POINT TO POINT

Digital Points

TEST	ACTION	OBSERVATION	OUTCOMES
PLANT	*QANTITY*	*ACTION*	*RESULT* ✓
Plc	Fault	Activate the PLC fault (in the PLC) and ensure that the alarm appears on IDTS	☑ ✓
Sewage_pumping_ station	Both_stations_running	SIMULATE both stations running pumps and ensure that the alarm appears on IDTS	☑ ✓
Sewage_pumping_ station	Common_fault	Activate the common fault (in the PLC) and ensure that the alarm appears IDTS	☑ ✓
Sewage_pumping_ station	Interlocked	Un-inhibit a pump and ensure that the Interlock "Event" appears on IDTS and that the Picture shows "INTERLOCKED" on the screen.	☑ ✓ But Point PICTURE going thru: NOT WORKING
Sewer_pump	Available	Make pump 1 un-available and ensure that the alarm is received by IDTS and that the picture shows pump 1 with a red circle.	☑ ✓
Sewer_pump	Available	Make pump 2 un-available and ensure that the alarm is received by IDTS and that the picture shows pump 1 with a red circle.	☑ ✓
Sewer_pump	Available	Make pump 3 un-available and ensure that the alarm is received by IDTS and that the picture shows pump 1 with a red circle.	☑ ✓
Sewer_pump	Available	Make pump 4 un-available and ensure that the alarm is received by IDTS and that the picture shows pump 1 with a red circle.	☑ ✓
Sewer_pump	Running	Run Pump 1 and ensure the event is received by IDTS and that the picture shows the pump as running	☑
Sewer_pump	Running	Run Pump 2 and ensure the event is received by IDTS and that the picture shows the pump as running	☑
Sewer_pump	Running	Run Pump 3 and ensure the event is received by IDTS and that the picture shows the pump as running	☑
Sewer_pump	Running	Run Pump 4 and ensure the event is received by IDTS and that the picture shows the pump as running	☑ ✓

Brisbane Water – Networks Control Officer

Name: G TIMMS

Signature: GT

Date: 29/3/5

HVAC Representative

Name: William Wong

Signature: William Wong

Date: 29/03/05

TEST	ACTION	OBSERVATION	OUTCOMES
PLANT	*QANTITY*	*ACTION*	*RESULT*
Wet_well	High	Simulate a high wet well level and ensure that the alarm is received by IDTS and that the wet well in the picture show high (red)	☑
Wet_well	Invalid	Open circuit the wet well level signal and ensure that the invalid	☑
Wet_well	Low	Simulate a low wet well level and ensure that the alarm is received by IDTS	☑
Wet_well	Surcharge_imminent	Activate the temporary well surcharge imminent probe and ensure that the alarm is received by IDTS and that the wet well in the picture show high (red)	☑
Wet_well	Surcharge_occuring	Simulate the temporary well surcharge occurring level and ensure that the alarm is received by IDTS and that the wet well in the picture show high (red)	☑

Analog Signals

TEST	ACTION	OBSERVATION	OUTCOMES
PLANT	*QANTITY*	*ACTION*	*RESULT*
Wet_well	Level_range_Fbk	Check that the RTU value matches the IDTS value	☑
Wet_well	Zero_MAHD_Fbk	Check that the RTU value matches the IDTS value	☑
Wet_well	Level	Check that the RTU value matches the IDTS value	☑
Wet_well	High_limit_Fbk	Check that the RTU value matches the IDTS value	☑
Wet_well	Low_limit_Fbk	Check that the RTU value matches the IDTS value	☑

Control Signals

TEST	ACTION	OBSERVATION	OUTCOMES
PLANT	*QANTITY*	*ACTION*	*RESULT*
Wet_well	High_limit	Send a high limit and check that the RTU value matches the IDTS value	☑
Wet_well	Low_limit	Send a low limit and check that the RTU value matches the IDTS value	☑

Brisbane Water – Networks Control Officer	HVAC Representative
Name: G TIMMS	Name: William Wong
Signature: GT	Signature: William Wong
Date: 29/3/5	Date: 29/03/05

Brisbane City

Brisbane Water

BRISBANE WATER

Network Control Systems

PRE-COMMISSIONING ACCEPTANCE TEST DOCUMENT

SPSV3 - Sewage Pumping Station Submersible 3 Pumps With VFD

Project & Commissioning Details

Date Commissioned	
Project Manager	
Construction Manager	
Electrical Inspector	
RTU Programmer (NCS)	
Electricians	

PRE-COMMISSIONING CHECK LIST (FOR ELECTRICAL INSPECTOR)

SP: _ _ _

LOCATION: ____________________

This check list is to be performed before the official IDTS commissioning of the sewerage pump station.

MAINS FEED

Task	Outcome
Submit Energex Form 2 (Application for supply)	OK ☐
Install switchboard, and check mains wiring	OK ☐
Test the earth stake resistance	_____ohms
Submit Energex Form 4 (Ready for power)	OK ☐
Energex connects power and seals meter box	OK ☐
Check that the phase orientation of the mains is correct and balanced.	OK ☐

CABINET

Task	Outcome
Check that the limit switch works and turns off when the doors are closed.	OK ☐
Check that locks are fitted on all doors and keyed correctly.	OK ☐
Check that Energex meter lock is fitted on the meter box.	OK ☐
Perform a physical inspection of the site and switchboard to determine if it is safe.	Pass ☐ Fail ☐
Note any defects in switchboard. **(On Defect Sheet**)	
Contact the relevant people to have the defects rectified and determine whether site commissioning should be postponed.	Delay Commissioning ☐

MOTOR STARTER

Task	Outcome
Check that the motor starter is programmed and able to start the each pump	Pump 1 - OK ☐ Pump 2 - OK ☐ Pump 3 - OK ☐

Site pre-commissioned by (Electrical Inspector)	Pre-commissioning Test Sheet checked by NCS Project Officer
Name:	Name: ....
Signature:	Signature: ....
Date:	Date: ....

ANTENNA

Task	Outcome
Check that the antenna mast (pole) has adequate clearance from overhead power lines. ▪ 1.8 metres for LV line ▪ 3 metres for HV line ▪ Antenna should NOT be mounted vertically beneath a power line.	OK ☐
Check that antenna is pointing in the correct direction. (Bearing the same as the Radio Survey result)	OK ☐

PUMPS

Task	Outcome
Bleed the pumps to remove any air in the impeller housing	OK ☐
Check the motor current and determine whether it is "correct" for the size of pump. • Low current may indicate air in the pump or blocked pump. • A high current may indicate a rag jam in the pump impeller.	Pump 1 - OK ☐ Pump 2 - OK ☐ Pump 3 - OK ☐
Check that the pumps are running in the correct rotation direction by observing the torque reaction movement of the pump casing when pump starts (submersible pumps).	Pump 1 - OK ☐ Pump 2 - OK ☐ Pump 3 - OK ☐
Check that the each pump can develop the desired pressure in the raising main.	Pump 1 - OK ☐ Pump 2 - OK ☐ Pump 3 - OK ☐

SURCHARGE IMMINENT PROBE

Task	Outcome
Check that the surcharge imminent probe is fixed at the correct height and is operational. (Actually ground the electrode to ensure full ponit to point)	OK ☐

WET WELL PROBE

Task	Outcome
Calibrate the Vega probe.	OK ☐
Check that the "deragging" tube is fitted over the Vega and covers the pump start and stop range.	OK ☐
Look at the Pump Station switchboard plaque and confirm that the % values for • Duty A start • Duty A stop • Surcharge imminent • Surcharge occurring match the RTU settings and are valid for the site.	A Start ___ % A Stop ___ % Sur Im ___ % Sur Oc ___%

Site pre-commissioned by (Electrical Inspector)

Name: ....

Signature: ....

Date: ....

Pre-commissioning Test Sheet checked by NCS Project Officer.

Name: ....

Signature: ....

Date: ....

PRE-COMMISSIONING CHECK LIST (RTU PROGRAMMER)

SP: _ _ _

LOCATION: ____________________

This check list is to be performed before the official IDTS commissioning of the sewerage pump station.

RTU

Task	Outcome
Check that the RTU has the correct IP address set	IP Address ____.____.____.____ Subnet mask ____.____.____.____
Check that the RTU has the correct program code loaded	Code Name
Check CPU Firmware Version and Serial Number	Serial Number _________ Firmware Ver _________
Check that the .main file has been downloaded from the IDTS	OK ☐

BATTERY

Task	Outcome
Check that the battery is connected and charging (i.e. 24V across the terminals).	OK ☐
Check that the RTU is running off battery when the mains supply is isolated	OK ☐

MOTOR STARTER

Task	Outcome
Check that the RTU program has a sufficient time out window to allow starting and stopping of pumps without triggering fail to start or fail to stop alarm (sewer pump fault).	OK ☐

Site pre-commissioned by (RTU Programmer)	Pre-commissioning Test Sheet checked by NCS Project Officer
Name:	Name: ....
Signature:	Signature: ....
Date:	Date: ....

RADIO

Task	Outcome
Check that the antenna mast (pole) has adequate clearance from overhead power lines. ▪ 1.8 metres for LV line ▪ 3 metres for HV line ▪ Antenna should NOT be mounted vertically beneath a power line.	OK ☐
Check that antenna is pointing in the correct direction. (Bearing the same as the Radio Survey result)	OK ☐
Check the VSWR of the cable with the antenna connected.	_____VSWR
Check that the correct radio type has been installed - high or low (transmit frequency)	High ☐ Low ☐
Check that radio is set on the correct frequency for the desired base station.	Tx MHz Rx MHz
Check that the RSSI is similar to the signal strength obtained in the Radio Survey results. Check that the (BER) packet test is similar to the Radio Survey.	______RSSI ______% loss with 10 dB attenuation
Check that the antenna is mounted with the drain hole in the dipole facing towards the ground.	OK ☐
Check that the antenna cable joints are wrapped with weather proof tape.	OK ☐

WET WELL PROBE

Task	Outcome
Check that the range of the Vega is the same as the value in the RTU initialisation block.	Range ____ m
Check that the suspended length of the Vega matches the "zero" value (4mA) in the RTU initialisation block.	Zero ____ m
Look at the Pump Station switchboard plaque and confirm that the % values for • Duty A start • Duty A stop • Surcharge imminent • Surcharge occurring match the RTU settings and are valid for the site.	A Start ___ % A Stop ___ % Sur Im ___ % Sur Oc ___%

Site pre-commissioned by (RTU Programmer)

Name: ....

Signature: ....

Date: ....

Pre-commissioning Test Sheet checked by NCS Project Officer

Name: ....

Signature: ....

Date: ....

APPENDIX B

BW NCS Site Acceptance Test Document

Brisbane City

Brisbane Water

BRISBANE WATER

Network Control Systems

SITE ACCEPTANCE TEST (SAT)
TEST DOCUMENT (On Site)

SPSV3 - Sewage Pumping Station
Submersible 3 Pumps With VFD

Project & Commissioning Details

Date Commissioned	
Project Manager	
Construction Manager	
Electrical Inspector	
RTU Programmer	
Electricians	

IDTS COMMISSIONING TEST SHEET

SP: _ _ _

LOCATION: ____________________

The purpose of these tests is to confirm that the new RTU is running and responding to inputs and sending data back to the IDTS master station.

- Notify Control Room that site is being commissioned - ph 340 78414
- Contact IDTS Test Room ph 3407 8477 to confirm receipt of alarms

IDTS COMMISSIONING TEST SHEET

Action	Observation	Result
Site in remote mode Switch on RTU power	Confirm that RTU ABNORMAL OPERATION alarm is received by IDTS Confirm that operator ajustable alarm setpoints are downloaded on RTU restart.	☐ Yes ☐ Yes
Cycle the mains power	Confirm that SITE POWER MAINS FAIL alarm is received by IDTS and no other alarms [alarm suppression] are sent	☐ Yes
Switch off RTU mains power	Confirm that RTU MAINS FAIL alarm is received by IDTS	☐ Yes
Trigger RTU Battery Low alarm	Confirm alarm is received by IDTS	☐ OK
Test operation of all pumps in REMOTE mode (Manual)	Each pump starts and stops when commanded by the IDTS picture controls	☐ OK
Activate the probe itself to produce the surcharge imminent alarm.	Confirm that 2 pumps start	☐ Yes
	Confirm that SURCHARGE IMMINENT alarm is received by IDTS	☐ Yes
Switch site to LOCAL and STOP pumps Wait until surcharge pumping timer expires (Record Time)	Confirm that LOCAL mode alarm is received by IDTS	☐ Yes
Test operation of all pumps in LOCAL mode	Each pump starts and stops when commanded by the site pushbuttons	☐ OK
Switch off RTU Test operation of both pumps in LOCAL mode with RTU failed.	Each pump starts and stops when commanded by the site pushbuttons	☐ OK
Site in Remote mode, RTU operating Test operation of the pump inhibit	Apply pump inhibit to each pump and confirm that "station inhibit" is active	☐ OK
Fault Pump 1 *Note: not every point that causes an availability alarm is tested, as this linkage is proved by SPSS2 standard code and FAT of switchboard*	Confirm Availability alarm is received by IDTS. Look at the points page and confirm the reason for the fault. Send a remote reset to clear the fault	☐ OK ☐ OK ☐ OK
Fault Pump 2	Confirm Availability alarm is received by IDTS. Look at the points page and confirm the reason for the fault. Send a remte reset to clear the fault	☐ OK ☐ OK ☐ OK

Action	Observation	Result
Fault Pump 3	Confirm Availability alarm is received by IDTS.	☐ OK
	Look at the points page and confirm the reason for the fault.	☐ OK
	Send a remte reset to clear the fault	☐ OK
Trigger Wet Well Surcharge Occurring Alarm	Confirm alarm is received by IDTS	☐ OK
Trigger Wet Well High alarm	Confirm alarm is received by IDTS	☐ OK
Trigger Wet Well Invalid Alarm	Confirm alarm is received by IDTS	☐ OK
Allow well to fill.	Observe that the duty pump starts and stops. Only need to test for 1 pump on a slow filling site.	☐ Yes
	Confirm that IDTS is receiving the correct wet well level (%).	☐ Yes
Pump start and stop values shown on the wet well label match the IDTS picture	Duty A start ....% Duty A stop ......%	
After several hours operation, Check trending	Wet well level	☐ OK
	Wet well inflow Is the value realistic?	☐ OK
	Estimated time to surcharge Is the value realistic?	☐ OK
	Running Indication Received?	☐ OK
	Pump current for each pump	☐ OK

Site FAT by (RTU Programmer)

Name: ....

Signature: ....

Date: ....

Pre-commissioning Test Sheet checked by NCS Project Officer

Name: ....

Signature: ....

Date: ....

PID TUNING

SP: ___

LOCATION: ____________________

This test can only be carried out if the inflow to the station is greater than the flow that one pump produces at minimum speed. The tuning of the loops should be rechecked after a 24 hour period (on trending) to ensure the station operates correctly over the varying flows during the day.

LOOP 3 – WET WELL LEVEL → PUMP SPEED

Action	Observation	Result
Level reaches the Duty A start level	• Pump runs at minimum speed • Wet well will continue to rise	☐ Yes ☐ Yes
Level reaches the PID set point level and continues to rise	• Pump speed will increase in a controlled manner until the level starts to fall. • Over time the should drop to the PID set point.	☐ Yes
Level falls below the PID set point level	• Pump speed will reduce in an attempt to maintain the PID set point level.	☐ Yes
Check the trending of the site.	• Overall the pump speed should change in a controlled maner. • The wet well level should be fairly constant, around the PID set point. • Unless the inflow to the site is greater than the flow of one pump running at max speed, the station should only run one pump – the speed should change quickly enough to avoid the starting of the second pump.	☐ Yes
PID CONSTANTS RECORDED IN INIT BLOCK	• Once the PID loop has been tuned, all constants in the INIT block must be recorded (ie the init value should equal the current value) so that the loop is tuned on the code as well as the running program.	☐ Yes

Site FAT by (RTU Programmer)	Pre-commissioning Test Sheet checked by NCS Project Officer
Name:	Name: ....
Signature:	Signature: ....
Date:	Date: ....

LOOP 1 & 2 – CASCADED - WET WELL LEVEL → FLOW → PUMP SPEED

Action	Observation	Result
Level reaches the Duty A start level	• PID Loop 1 will request the minimum flow. • PID Loop 2 will run the pump at minimum speed and will increase the speed if the minimum flow is not achieved. (It should be close tho). • Wet well will continue to rise	☐ Yes ☐ Yes ☐ Yes
Level reaches the PID set point level and continues to rise	• PID Loop 1 will increase the flow set point. • PID Loop 2 will increase the pump speed to achieve the new flow SP. • The pump speed increases in a controlled manner, the level will eventually start to fall. • Over time the well level should drop to the PID set point.	☐ Yes ☐ Yes ☐ Yes ☐ Yes
Level falls below the PID set point level	• PID Loop 1 will decrease the flow set point. • PID Loop 2 will decrease the pump speed to achieve the new flow SP	☐ Yes ☐ Yes
Check the trending of the site.	• Overall the flow SP and the pump speed should change in a controlled maner. • The flow should be stable, with no large variations over a small time period. A steady increase/decrease is what is desired. • The wet well level should be fairly constant, around the PID set point. • Unless the inflow to the site is greater than the flow of one pump running at max speed, the station should only run one pump – the flow SP, and thus the speed, should change quickly enough to avoid the starting of the second pump. (Must be balaced with the previous condition)	☐ Yes ☐ Yes ☐ Yes ☐ Yes
PID CONSTANTS RECORDED IN INIT BLOCK	• Once the PID loop has been tuned, all constants in the INIT block must be recorded (ie the init value should equal the current value) so that the loop is tuned on the code as well as the running program.	☐ Yes

Site FAT by (RTU Programmer)

Name: ....

Signature: ....

Date: ....

Pre-commissioning Test Sheet checked by NCS Project Officer

Name: ....

Signature: ....

Date: ....

APPENDIX C

BW Vega Level Transmitter Calibration

Brisbane City

Brisbane Water

HEROES AVENUE
Vega Calibration
Results - 18-07-05

	TRANSMITTER OUTPUT		
(MWG) Induced Pressure	(mA) Theoretical	(mA) As Found	(mA) As Left
0	4.00	4.1	4.01
25	8.00	—	8.03
50	12.00	—	12.04
75	16.00	—	16.04
100	20.00	20.45	20.00

Comments:

Test Instrument Serial Numbers
1 8428005 FLUKE 787 (CAL. DATE) 17/05/06
2 12970/95-4 DRUCK 20/04/06
3
4

Signatory [signature] Payroll Number 39560 Date 22-07-05

ENGINEERING

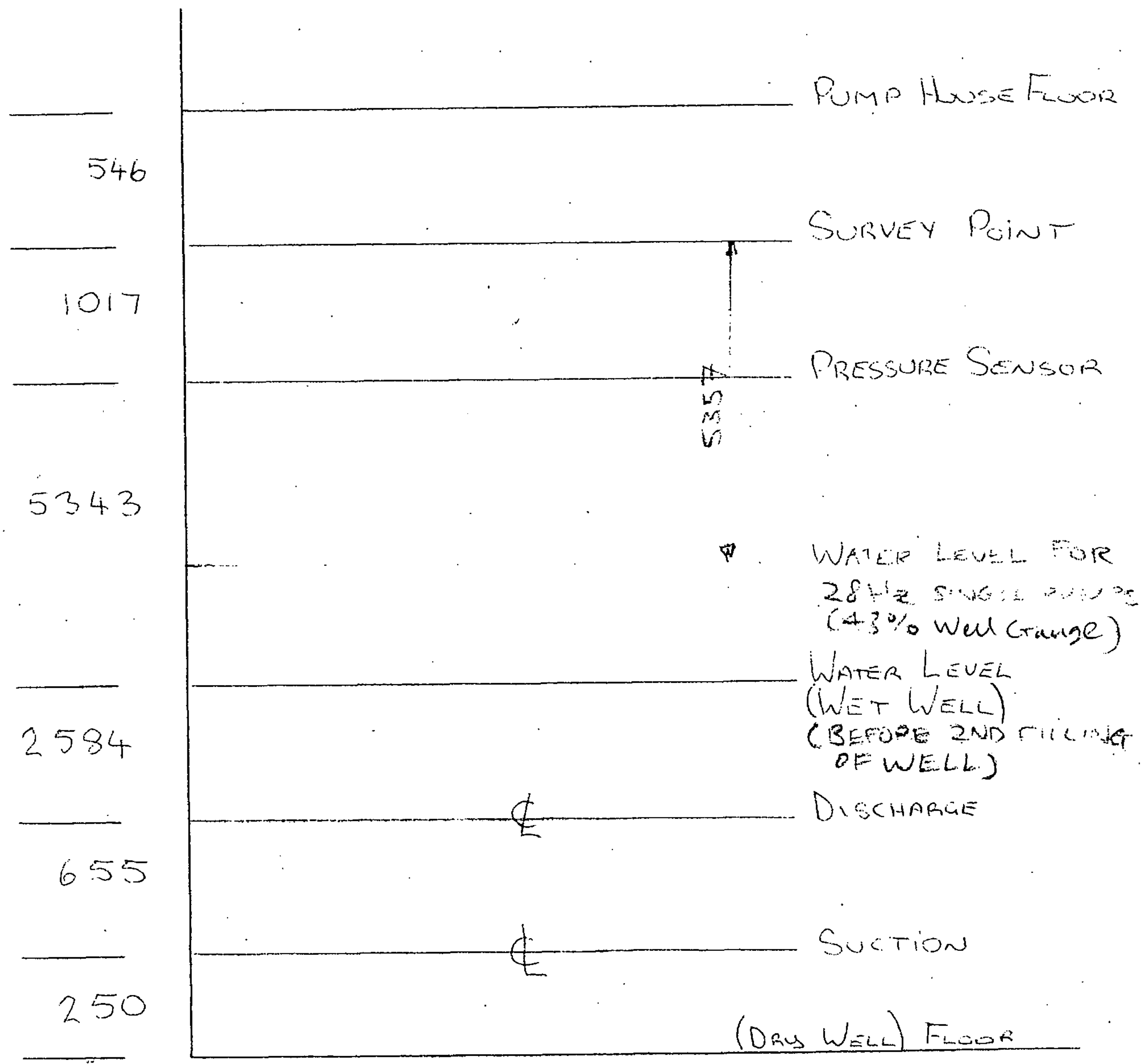
JOB No. 3251Q

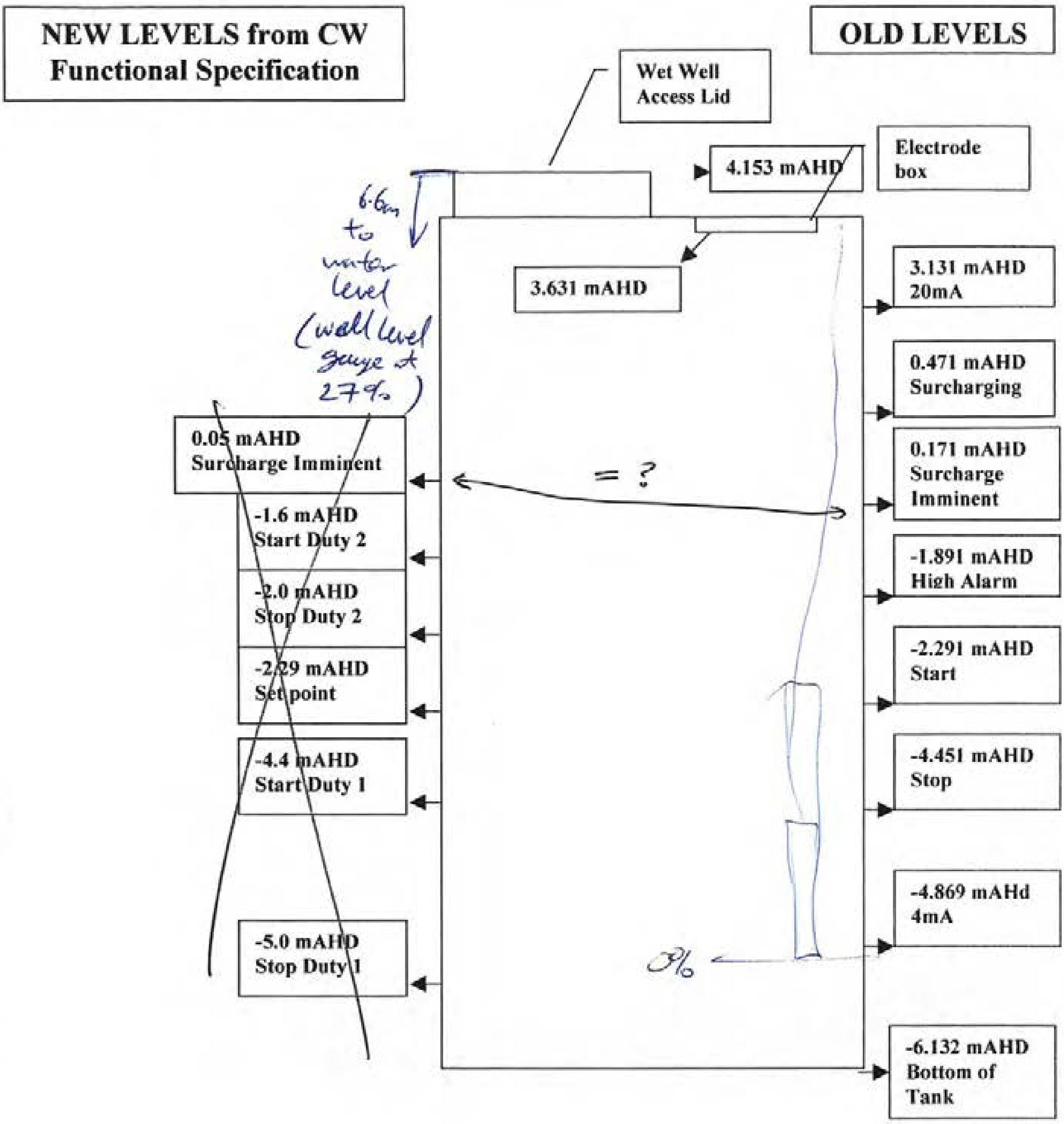
JOB BRISBANE WATER

DATE 9-8-05

SECTION OF JOB HEROES AVE (DUMPY LEVELS)

PAGE





6.5m from water to wet well top lid

(water level ≈ at -2.347mAHD)

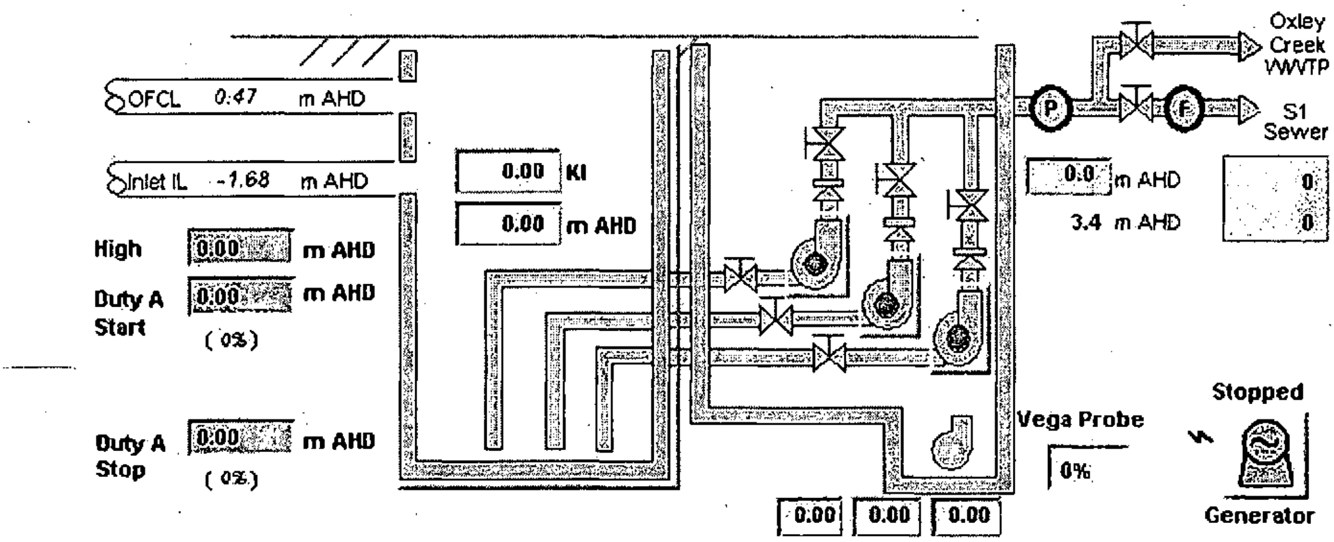
· ~~25% of -4.87 mAHD ≈ 1-27 mAHD~~

~~water Level at -3.6~~

Brisbane City

Brisbane Water

BRISBANE WATER



Network Control Systems

FUNTIONAL SPECIFICATION

SP103 Heroes Ave

Sewage Pumping Station

Conventional 3 Pumps With VSD

Document Signoff

Approval

	Name	Role	Signature	Date
Supervising Elec. Eng *Engineering Design Services*	Alan Mooney	Recommend		
Supervising Elec. Eng *Engineering Design Services*	Henri Lai	Concur		
Team Leader *Network Control Systems*	Peter Sherriff	Concur		
Manager *System Planning*	Peter Casey	Concur		
Manager *Water & Sewerage Operations*	George Henry	Concur		
Manager *Mechanical And Electrical Services*	Michael Greene	Concur		
Project Manager	Andy Moore	Approve		

Distribution

	Name	Role	Section

Revision Control

Revision Number	Date	Amendment Details	Responsible Officer
Version 0.00	17/05/2005	Original Draft – Developed from Cardino SP103 Revised Functional Spec	Alex Witthoft

Document Consultation

Please review the attached document and add your comments where necessary. To ensure that the process is kept within reasonable timeframes, it would be appreciated if you could return this document by the **Requested Return Date** listed below.

Project Sponsor:	Andy Moore	Officer Code: PM13BW	Location: T.C.B. Level 2
Author:	Alex Witthoft	Officer Code: CTAMP12	Location: Cullen Ave
Document Administrator:	Alex Witthoft	Officer Code: CTAMP12	Location: Cullen Ave

Version Number (1,2,3 etc)	Forwarded To (Name / Officer Code)	Location (eg TCB, Cullen Ave)	Date Sent	**Requested Return Date**	Date Returned	Comments Received (Y / N)	Comments Incorporated (Y / N)

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Definitions

IDTS	Integrated Departmental Telemetry System
RTU	Remote Telemetry Unit
SCADA	Supervisory Control And Data Acquisition
MAHD	Metres above Australia Height Datum

1 INTRODUCTION

This document contains the site specific details and describes the non standard functional requirements for control, monitoring and telemetry at sewage pump station SP103 at Heroes Avenue Taringa. The functional requirements described in the document are in addition to the standard functionality detailed in "SPSV3 SEWAGE PUMPING STATION SUBMERSIBLE 3 PUMPS WITH VFD" [1].

The standard specification was written for a 3 pump station, of which only 2 pumps are allowed to run at any given time. The functionality for SP103 Heroes Avenue is identical, with the site specific values detailed in this document.

The site specific details and the non standard functional requirements in this document were derived from the functional specification written by Cardino Davis Pty Ltd "HEROES AVENUE FUNCTIONAL SPECIFICATION.DOC" [2].

SP103 is a sewage pump station incorporating three variable speed driven 125 kW dry mounted submersible pumps operating in a two duty and one standby arrangement. SP103 is located in Taringa near Perrin Park.

The proposed refurbished Sewage Pumping Station will be an underground conventional sewage pumping station with an existing Average Dry Weather Flow (ADWFe) of 52 l/sec, ultimate ADWFu of 75 l/sec and an average operating wet well volume of 34 kl. The pump station will have three sewage pumps installed in the Pump Dry Well operating with two duty and one standby unit. The pumps will be interlocked so that only two pumps can operate at any time. The station output with one pump operating at minimum speed will be approximately 60 l/sec, and with two pumps operating at maximum speed will be approximately 360 l/sec under wet weather conditions.

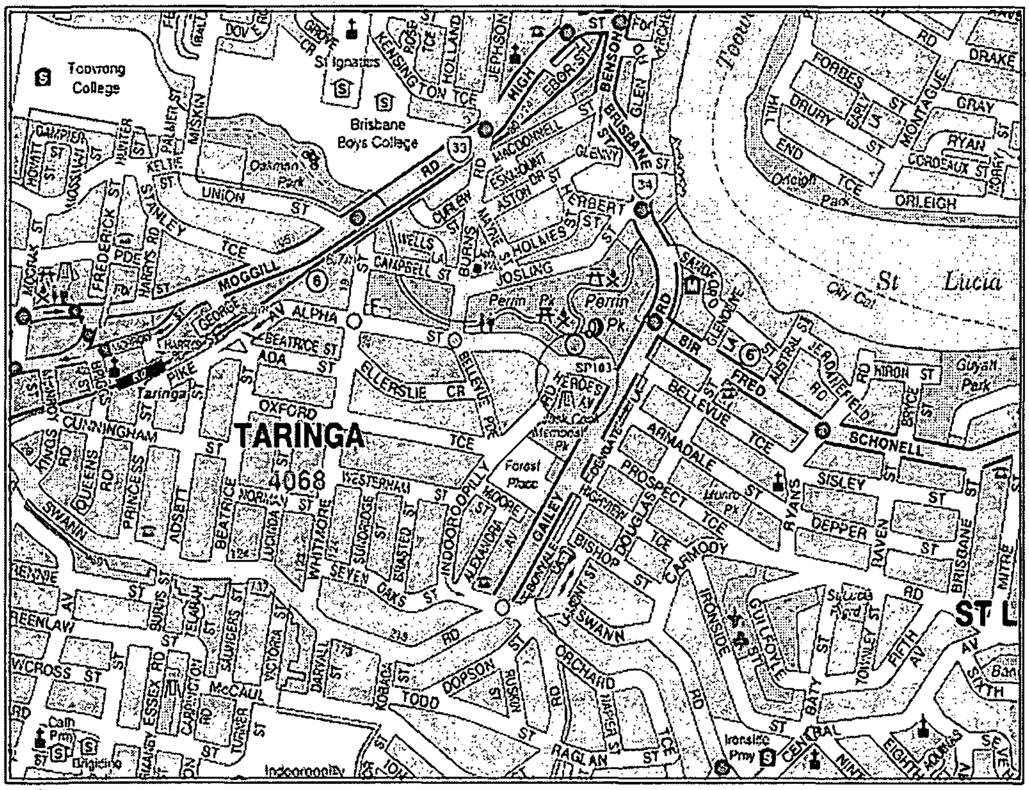


Figure 1: SP103 Location Map

1.1 Background to the Project

The capacity of the existing Heroes Avenue Pump Station has been exceeded. The existing pumps are only able to deliver 2.9xADWF before surcharging, which is below the Brisbane Water design standard of 4xADWF. This has resulted in the potential for unacceptable overflows from the pump station.

In addition, there have been increased odour complaints received from residents in the areas around the pump station. The odour issues are most likely related to the large wet well volume changes associated with the current start/stop operation, whereby H_2S is released via the vent.

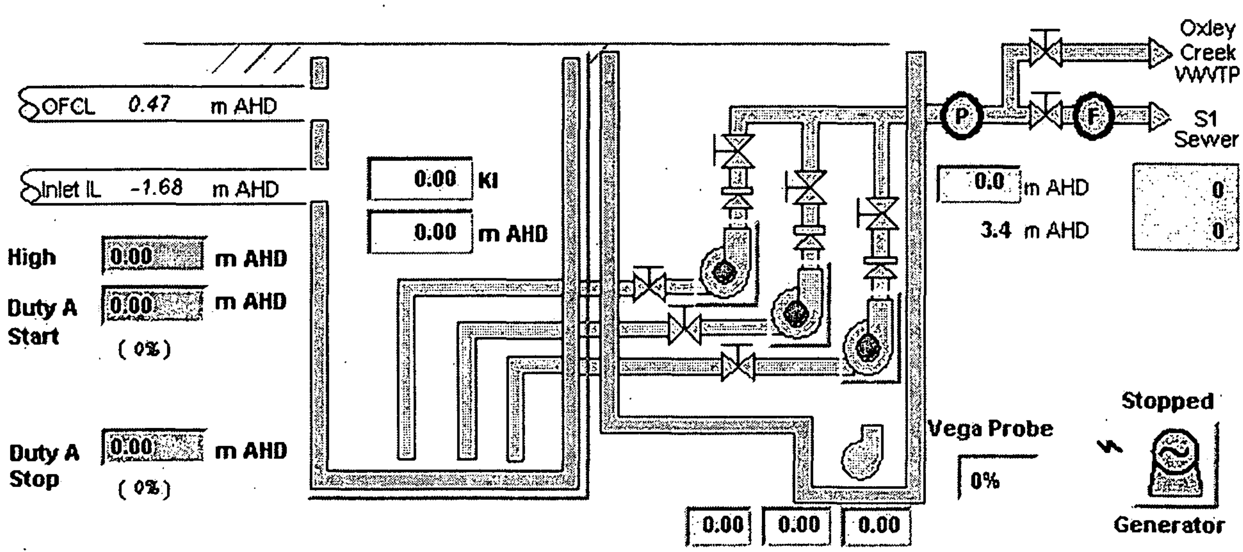
The upgrade involves increasing the capacity of the pump station, minimising odour generation and redirection of flows from the S2 catchment to the S1 catchment via a new rising main along Coronation Drive.

It is intended to upgrade the existing Heroes Avenue wet well and install new pumps in the existing dry well and controls in the existing structure. The existing dry well pump station structure shall be retained to house the switchboard and the new pumps. The existing pumps and valves, switchboard, resistor banks and RTU cabinet shall be de-commissioned and removed to make way for the new equipment.

1.2 General Process Description

When the Pump Station is in Remote Auto mode, the pumps shall be controlled such that the pump station output for one pump shall be between approximately 60 l/sec (minimum) to approximately 260 l/sec (maximum). When two pumps operating and the wet well level is approaching surcharge level, the station output shall be increased to at least 360 L/sec.

Control of the pump station will be based on the current state of the wet well level with the pumps operating in a Duty 1/Duty 2/Standby configuration. Under normal conditions, with the wet well rising and the wet well level signal valid, the site will operate in a level mode affected by a Proportional/Integral/Derivative (PID) Controller that will reside in



the PLC.

Figure 2: SP103 Process and Instrumentation Overview

2 EQUIPMENT INSTALLED

2.1 Standard Equipment

SP103 Heroes Ave pump station has the following standard equipment installed. The functionality for the control, monitoring and alarming for these items is fully described in the standard functional specification.

Pumps	Three Hidrostal submersible pumps with 125 kW four pole electric motors are installed in the dry well. Each pump is fitted with moisture probes in the oil chamber and thermistors in the stator windings.
Pump Starters	Three Danfoss Variable Frequency Drives (VFDs) are installed in the pump station switchboard. The VFDs will also provide soft starting functionality.
Flow meters	One buried ABB Magmaster electromagnetic flow meters are installed in the discharge mains. The flowmeter will be used in the flow control algorithm (PID Loop) to control the speed of the pumps.
Level Sensors	One Vega hydrostatic level transmitter installed in the wet well.
	One Multitrode level probe (Surcharge imminent) installed in the wet well.
Pressure Transmitters	One Vega D84 pressure transmitters are installed on the discharge side of the pumps.

2.2 Non Standard Equipment

SP103 Heroes Ave pump station has the following non standard equipment installed. The functionality for the control, monitoring and telemetry for is described in the following sections as these items are NOT described in the standard specification.

Emergency Generator	One SE Power 500 kVA diesel powered backup generator is installed on a slab adjacent to the valve chamber. The generator includes its own GE FANUC PLC mounted in a dedicated control panel inside the generator housing.
Sump Pump	Existing sump pump installed in the sump of the dry well
Level Sensors	One Multitrode level probe (start /stop sump pump) installed in the sump of the dry well.
	One Multirode level probe (dry well high and trip alarms) installed in the dry well.

2.2.1 Emergency Generator

The emergency generator is designed to the standard functionality as described by "DIESEL STANDBY GENERATOR LOCAL CONTROL PANEL FUNCTIONAL DESCRIPTION". [3] The generator is supplied with the PLC fully configured and loaded with the standard program. The RTU (Logica MD3311) will programmed with the standard interface program that will provide the monitoring, control and telemetry to the IDTS master station.

2.2.2 Sump Pump

Thr dry well in which the pumps and reflux valves are housed will have a sump pump installed to ensure the well does not flood due to water ingress from the environment or from leaks in the pipework. The sump pump used will be the existing sump pump in the dry well.

2.2.3 Dry Well Level Monitoring

The dry well will have two multitrode electrodes installed to monitor two levels above the normal start/stop levels of the sump pump. The dry well high alarm will be used as the alarm level to indicate the dry well level is rising to above normal levels. The dry well trip level is installed at the level at which the sewer pumps are no longer safe to run. If this level is reached, all sewer pumps are locked out from running until the level is reduced and the reset button is pressed on site.

3 CONTROL PHILOSOPHY

The station will operate according to the control philosophy detailed in the standard functional specification (SPSV3). The initialisation block will be configured with the site specific set points listed in the tables in the next sections.

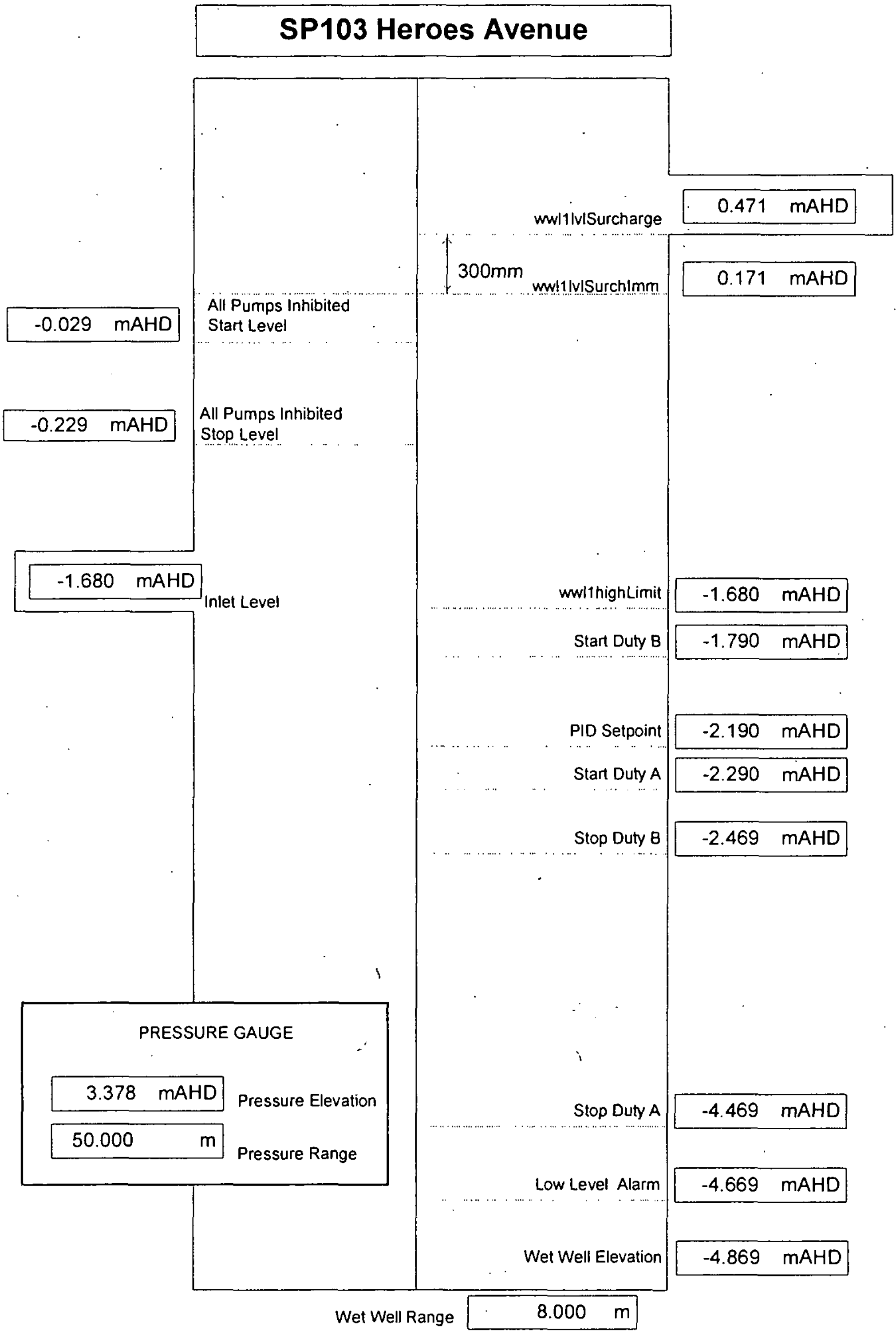


Figure 3: SP103 Station Level Set Points

SOME LEVELS MAY CHANGE ACCORDING TO COMMISSIONING FIGURES

3.1 Site Specific Values

Table 1: Site Specific Constants defined in the PLC

Tag Name	Description	Type	Value	Units
Sewerage Pumping Station				
Stn01grSurchPumpingTime	Surcharge pumping duration [3]	Integer	[illegible]	Sec
Delivery flow				
Flw0[x]txRange	Delivery flow – Range	Real	400	l/s
Stn01grMinFlow1Pmp	Delivery flow – Minimum flow	Real	50	l/s
Stn01grMaxFlow1Pmp	Delivery flow – Maximum flow – 1 Pump	Real	260	l/s
Stn01grMaxFlow2Pmp	Delivery flow – Maximum flow – 2 Pumps	Real	360	l/s
Delivery pressure				
Pre01txRange	Delivery pressure - Range	Real	5000	mmAHD/10
Pre01txZero	Delivery pressure – Elevation of the transducer	Real	337	mmAHD/10
Pump Blockage				
Stn01grPmpBlockFlowKneeSP	Flow blocked limit for flow/level PID control (knee)	Integer	[illegible]	l/s x 100
Stn01grPmpBlockSpeedKneeSP	VFD speed blocked limit for flow/level PID control (knee)	Integer	[illegible]	Hz x 100
Stn01grPmpBlockSpeedMinSP	VFD speed blocked limit for minimum flow PID control	Integer	[illegible]	Hz x 100
Wet well level				
Wwl01txRange	Wet well level range	Integer	8000	mmAHD
Wwl01txSurchImmLevelSP	Wet well surcharge imminent level	Integer	171	mmAHD
Wwl01grInhStartLevelSP	Wet well inhibit mode start level	Integer	-29	mmAHD
Wwl01grInhStopLevelSP	Wet well inhibit mode stop level	Integer	-229	mmAHD
Wwl01grRunatMaxLvlSP	Wet well run at maximum speed level	Integer	-1680	mmAHD
Wwl01txDtyBStartLevelSP	Wet well duty B pump start level	Integer	-1790	mmAHD
Wwl01txPIDLevelSP	Wet well PID set point	Integer	-2190	mmAHD
Wwl01txDtyAStartLevelSP	Wet well duty A pump start level	Integer	-2290	mmAHD
Wwl01txDtyBStopLevelSP	Wet well duty B pump stop level	Integer	-2469	mmAHD
Wwl01txDtyAStopLevelSP	Wet well duty A pump stop level	Integer	-4469	mmAHD
Wwl01txZero	Wet well empty level (4mA of Probe)	Integer	-4869	mmAHD
Variable Frequency Drive				
Stn01grMinSpeed	Variable Frequency Drive – Minimum Speed	Integer	2500	Hz x 100
Stn01grMaxSpeed	Variable Frequency Drive – Maximum Speed	Integer	5000	Hz x 100

Table 2: Site Specific Constants defined in the RTU

Tag Name	Description	Type	Value	Units
flw1almInhibitTm	Delivery flow - Alarm inhibit timer	Integer	15	sec
pre1almInhibitTm	Delivery pressure - Alarm inhibit timer	Integer	15	sec
wwl1surchLvlVol	Wet well volume at surcharge level	Real	193.090	kl
wwl1lvlSurcharge	Wet well surcharge occurring level	Real	0.470	mAHD
Pumps 1 & 2				
Pmp[x]almInhPwrTm	Pump [x] - Motor power alarm inhibit timer.	Integer	15	sec
pmp[x]almInhCrntTm	Pump [x] - Motor current alarm inhibit timer.	Integer	15	sec
pmp[x]currRange	Pump [x] - Motor current range	Real	[illegible]	Amps

Table 3: Site Specific Variable defined in the RTU

Wet well level				
wwl1highLimit	Wet well level - High alarm set point	Integer	-1680	mmAHD
wwl1lowLimit	Wet well level - Low alarm set point	Integer	-4669	mmAHD
Delivery flow				
flw1highLimit	Delivery flow - High alarm set point	Integer	max	ml/s x 10
flw1lowLimit	Delivery flow - Low alarm set point	Integer	min	ml/s x 10
Delivery pressure				
pre1highLimit	Delivery pressure DN1370 – High alarm set point	Integer	max	mmAHD
pre1lowLimit	Delivery pressure DN1370 – Low alarm set point	Integer	min	mmAHD
Pumps 1 & 2				
pmp[x]currHiLimit	Pump [x] - Motor current high alarm set point [4]	Integer	[illegible]	mAmps
pmp[x]currLoLimit	Pump [x] - Motor current low alarm set point [5]	Integer	[illegible]	mAmps
pmp[x]powHiLimit	Pump [x] - Motor power high alarm set point	Integer	[illegible]	Watts
pmp[x]powLoLimit	Pump [x] - Motor power low alarm set point	Integer	[illegible]	Watts

Table 4: Wet Well Level vs Volume Data

	Height (mAHD)	Volume m^3	Remaining Storage m^3	% Level	% Volume
1	-4.451	0.000	193.090	5.2%	0.0%
2	-4.191	4.120	188.970	8.5%	2.1%
3	-3.932	8.240	184.850	11.7%	4.3%
4	-3.673	12.360	180.730	15.0%	6.4%
5	-3.414	16.480	176.610	18.2%	8.5%
6	-3.155	20.600	172.490	21.4%	10.7%
7	-2.896	24.720	168.370	24.7%	12.8%
8	-2.637	28.840	164.250	27.9%	14.9%
9	-2.291	34.353	158.737	32.2%	17.8%
10	-2.119	37.090	156.000	34.4%	19.2%
11	-1.891	41.535	151.555	37.2%	21.5%
12	-1.601	49.274	143.816	40.9%	25.5%
13	-1.342	59.957	133.133	44.1%	31.1%
14	-1.083	71.388	121.702	47.3%	37.0%
15	-0.824	85.216	107.874	50.6%	44.1%
16	-0.565	107.139	85.951	53.8%	55.5%
17	-0.306	123.180	69.910	57.0%	63.8%
18	-0.047	140.067	53.023	60.3%	72.5%
19	0.211	161.091	31.999	63.5%	83.4%
20	0.471	193.090	0.000	66.8%	100.0%

3.2 Non Standard Control

3.2.1 Emergency Mode

The station will retain the ability to pump to Oxley Creek via the Indooroopilly rising main for emergency situations. This will be achieved through the manual control of valves to redirect the flow from the S1 rising main to the Indooroopilly rising main. As there is no valve position indication, a selector switch will be installed to allow the selection between Emergency and Normal mode.

RULES: 1. The station must be placed into emergency mode BEFORE the valves are moved (thus limiting the station to one pump before the Indooroopilly line is opened)

2. The station can not be selected to normal mode UNTIL the valves are returned to the normal position (ie the S1 sewer rising main is opened).

PROCEEDURES FOR ENABLING EMERGENCY MODE MUST BE PRODUCED TO ENSURE THE ABOVE RULES ARE FOLLOWED. IF THESE RULES ARE NOT FOLLOWED THE INTEGRITY OF THE INDOOROOPILLY RISING MAIN CAN NOT BE GUARANTEED.

(A capital project is being planned to automate the valves and to provide the position of the valves to the PLC. This will enable the PLC to enable the emergency mode automatically by moving the valves in the correct order and applying the necessary limitation the pumping station).

Due to the pressure limitations in the Indooroopilly rising main the following restrictions will be implemented in the code whenever the site has been re-directed.

1. The station will be limited to run a maximum of one pump at a time (to produce a maximum flow of 160 l/s)
2. The speed required for a single pump will increase to 42 Hz to achieve the required minimum flow of 50 l/.

The above restrictions will be achieved by interlocking the pumps to allow only one pump to run under emergency mode and two pumps to run under normal mode. The following parameters will also change while the station is in emergency mode.

As there is no flowmeter on the Indooroopilly rising main, the station will run under proportional only control (ie the pump will start at minimum speed and increase in speed as the well rises to the maximum speed level set point).

Stn01grMaxFlow1Pmp	Delivery flow – Maximum flow – 1 Pump	Real	160	l/s
Stn01grMinSpeed	Variable Frequency Drive – Minimum Speed	Integer	4200	Hz x 100

3.2.2 Sump Pump

The sump pump shall start when the sump high level probe is reached and continue running until the level falls below the low level probe.

NOTE: Only the running status and fault status of this pump is monitored by the PLC with all the control being performed by hard wired control circuits.

3.2.3 Dry Well Level Monitoring

The pump well flooded trip flag will be latched if the dry well flooded trip digital input becomes active. This will cause all sewer pumps to become unavailable. The fault flag will be unlatched if the digital input becomes inactive and either pump local reset pushbutton is pressed.

3.3 Non Standard Monitoring and Alarms

3.3.1 Emergency Mode

Plant	Quantity	Priority
Sewage_pumping_station	Mode_selected	0

Sewage Pumping Station Mode Control / Selected

The current mode selection will be returned back to the IDTS master station via the feedback variable. The station mode selection can only be done on site via the mode selection switch by the on site technician.

3.3.2 Sump Pump

Plant	Quantity	Priority
Sump Pump	Running	0
Sump Pump	Excessive_running	3
Sump Pump	Excessive_cycling	3
Sump Pump	Fault	3

Running

Indication to the IDTS master station that the sump pump is running.

Excessive Running

The sump pump excessive run alarm flag will be set if the sump pump running signal is active for longer than the time period set by the sump pump excessive run alarm delay timer.

Excessive Cycling

The sump pump excessive cycling alarm flag will be latched if the sump pump restarts within a time period set by the sump pump excessive cycle delay timer. The alarm flag will be reset be reset by any of the sewer pump local reset buttons or the sump pump remote reset command from IDTS.

Fault

The sump pump healthy digital input signal is a combination of both the sump pump circuit breaker and the sump pump thermal overload status (in series). This input is fail safe (if either the circuit breaker or thermal overload is not healthy then this singal will not be active. The sump pump fault alarm is active if the sump pump healthy signal is not active.

3.3.3 Dry Well Level

Dry_well	High_alarm	1
Dry_well	Trip_alarm	3

High Alarm

The dry well flooded alarm flag will be latched if the dry well flooded alarm digital input is active for 10 seconds. This alarm provides a warning that the level in the dry well is rising above the sump and that the site needs to be attended before the dry well flooded trip level is reached (refer to next section). This alarm does NOT prevent the sewer pumps from operating. The alarm can only be reset at the site by an on site technician via any of the pump reset push buttons once the level is below the alarm electrode.

Trip Alarm

The dry well flooded trip flag will be latched if the dry well flooded trip digital input becomes active for 10 seconds. NOTE: This will cause all sewer pumps to become unavailable. The alarm can only be reset at the site by an on site technician via any of the pump reset push buttons once the level is below the trip electrode.

3.4 Non Standard IDTS Picture

3.4.1 Dry Well

The standard picture is of a three submersible pumps. The picture for SP103 Heroes Ave will consist of a wet well and an additional dry well, in which the pumps will be displayed. The dry well will also display the sump pump and the sump pit, which will be animated red when the high or trip alarms are active.

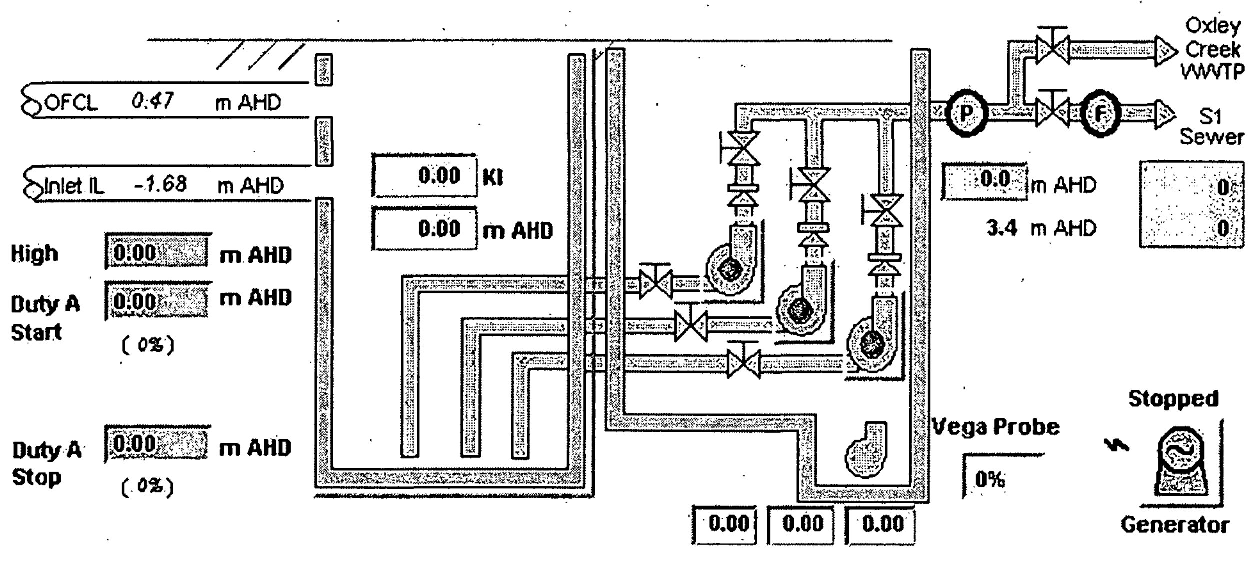


Figure 4 SP103 Details Page

3.5 Sewer Network Overview

Currently the SP103 Heroes Ave pump station is part of the S2 Oxley Creek sewer network (Indooroopilly/St Lucia sub area). As part of this project SP103 Heroes Avenue will be re-directed to the S1 Luggage Point sewer network. (NEED TO DETERMINE EXACTLY HOW THE SITE WILL INTEGRATE INTO THE S1 SEWER) Both the S1 and S2 network pages will be updated to reflect the new sewer connections.

The site will retain, for emergency use only, the ability to pump to Oxley creek via the Indooroopilly rising main. A future capital project will implement the automation of this process. (To actuate and control the valves automatically).

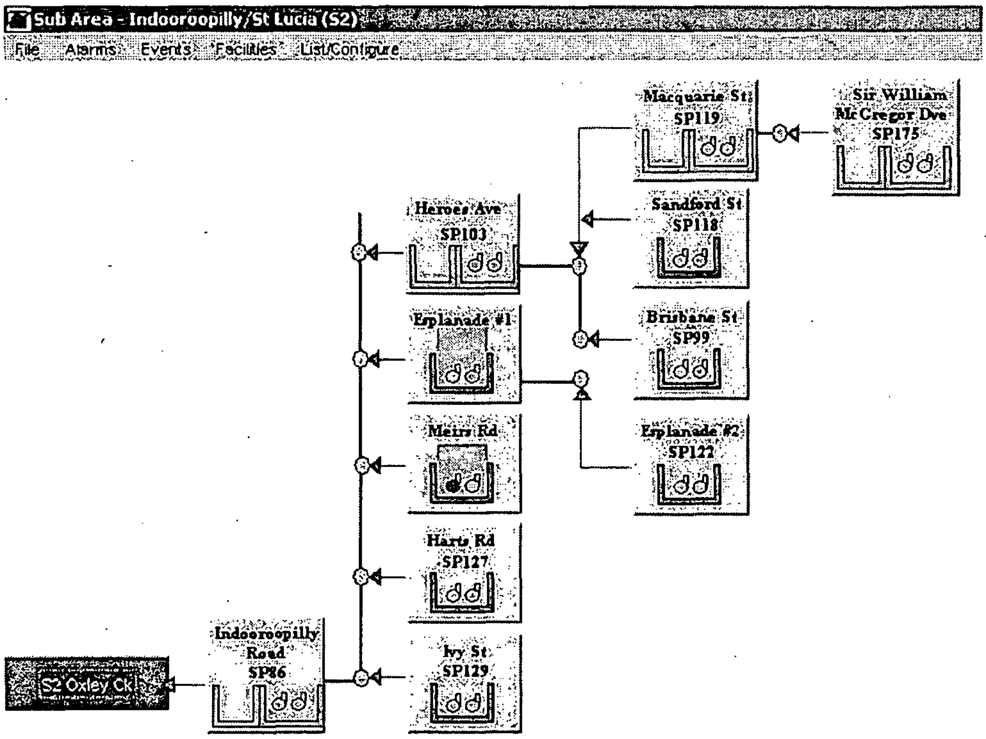


Figure 5 S2 Indooroopilly Sewer Overview Page

4 REFERENCES

1

TITLE	SPSV3 Sewage Pumping Station Submersible 3 Pumps With VFD – Functional Specification
DOCUMENT ID	003589
VERSION	0.30
AUTHOR	Alex Witthoft , Brisbane Water – Network Control Systems
DOCUMENT OWNER	Peter Sherriff, Brisbane Water – Network Control Systems

2

TITLE	Heroes Avenue Functional Specification
DOCUMENT ID	N/A
VERSION	N.A
AUTHOR	N.A
DOCUMENT OWNER	Cardino Davies Pty Ltd

3

TITLE	Diesel Standby Generator - Local Control Panel - Functional Description
DOCUMENT ID	N/A
VERSION	02
AUTHOR	SOUTH EAST POWER GENERATION
DOCUMENT OWNER	

VEGA

Prüfzertifikat

für Druckmessumformer

Test certificate for pressure transmitters

ISO 9001 Q CE

VEGA bestätigt, dass die zur Qualitätsprüfung des Erzeugnisses eingesetzten Messmittel gültig kalibriert und auf nationale Normale der Physikalischen Technischen Bundesanstalt (PTB) rückführbar sind.
VEGA confirms that all instruments used to assure the quality of our products are calibrated and traceable to national standards of PTB (Physikalischen Technischen Bundesanstalt)

VEGA Grieshaber KG, Am Hohenstein 113, 77761 Schiltach, Tel. 0 78 36/50-0, Fax. 0 78 36/50 201

Druckmessumformer / Pressure transmitter:	BAR64
Messbereich / Meassuring range:	-1 bis/to 10,0bar rel. -100 bis/to 1000 kPa rel.
Seriennummer / Series no.:	14447963
Ausgang / Output:	4 ... 20mA, HART
Zulassungen / Approvals:	OHNE

Kundennummer Customer ID	44741
Auftragsnummer Order number	1212305
Auftragsposition Order position	1

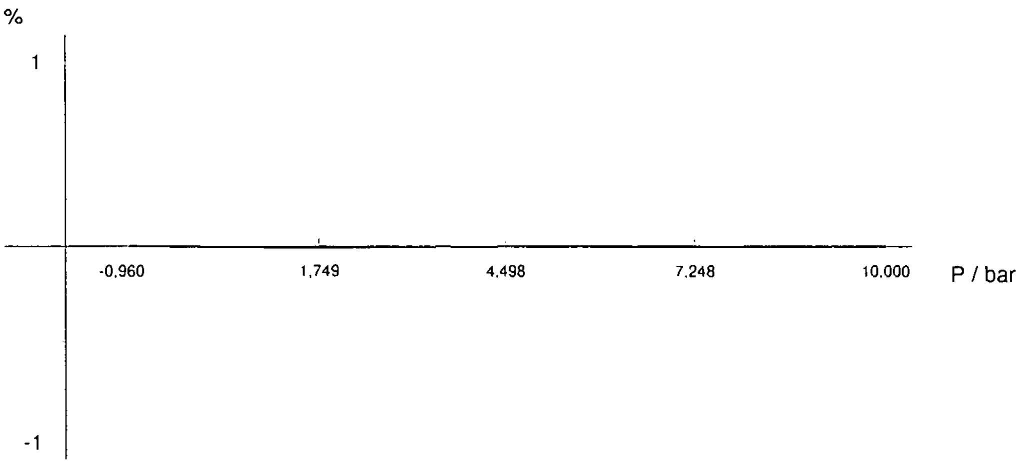
Kennwerte / Characteristics: -0,960 bis/to 10,000 bar rel.

0,36 bis/to 100,01 %

Kennliniencharakteristik / Output characteristics:

max. zul. Abweichung bezogen auf Messbereich: < 0,08 %
/ Dev. in linearity rel. to measuring range

Ref.-Druck / Ref. pressure [bar]:	-0,960	1,749	4,498	7,248	10,000
Soll-Ausgang / Ideal output [%]:	0,36	24,99	49,99	74,99	100,01
Ist-Ausgang / Real output [%]:	0,36	24,98	49,99	74,99	100,01
Abweichung / Accuracy [%]:	0,00	-0,01	0,00	0,00	0,00



Temperatureinfluss
/ Temperature influence:

Temperaturfehler bei 0 bar rel.
/ Temperature accuracy at 0 bar rel.

Bezogen auf den Messbereich / Related to the measuring range

ɘzugstemperatur 20 °C / Ref. temperature 20 °C

Temperatur [°C] Temperature	0	20	60	100
Ist-Ausgang [%] Real output	9,07	9,09	9,09	9,04
Abweichung [%] Accuracy	-0,01	0,00	0,00	-0,05

Datum / Date: 06.07.2005 **Unterschrift** / Signature:

ABB

Flowmeter Calibration Verification Certificate

‾ stomer	Brisbane Water
Date Performed	Thursday 21 July 2005 09:33
Date Certificate Printed	Monday 25 July 2005 08:40

Site Details

Location	SP 103
Tag	5428814
Operator	John Grant

Results :

Transmitter Zero	Pass
Transmitter Span	Pass
Transmitter Pulse Output	Not Tested
Transmitter Analogue Output	Pass
Sensor Electrode Integrity	Pass
Sensor Energising Coil Integrity	Pass

Declared "FULL" pipe status appears to be FULL.

RECEIVED
HVAC
27 JUL 2005

Accuracy :

The above tests and results verify that the flowmeter is functioning within normal working limits, and is within ±2% of original calibration certificate.

..ansmitter Settings

Sensor Calibration Factor	1.4035/2/5/1.000
Flow Range	500.0 l/s
Response Time Constant	3 seconds
Probe Factors	ins 1.00000, prof 1.00000
Analogue Output	4-20 Forward
Second Analogue Range	100.0% (500.0 l/s)
Pulse Output	Not Tested
Totaliser Units	Kilo l

Calmaster Details

Instrument, Serial No.	CM0139, V/38364/1/1
Last Calibrated	Tue 14 Dec 2004
Next Calibration Date	Wed 14 Dec 2005
Firmware Version	CalMaster v1.0 36/96
PC Software Version	v2.31 25/08/2004 (Intn.)
DVM Serial No.	
Resistor Serial No.	(Not Used)

Flowmeter Details

Type	MagMaster, Electromagnetic
Sensor S/No.	P/26949/3/5
Transmitter S/No.	vkh06125
Tag No.	5428814
Meter Size	350 mm

CalMaster is fully traceable to National and International Standards.
For details please refer to CalMaster Traceability Documentation.

ABB World Flow Technology Centres

ABB Limited.,
Oldends Lane, Stonehouse
Gloucestershire
England, GL10 3TA
Tel +44 (0) 1453 82 6661
ax +44 (0) 1453 82 1478

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125 E County Line Road,
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Fax +215-674-6394

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Moorebank
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Tel +61-2-9821-0111
Fax +61-2-9821-0950

ABB Limited,
Dranselder Str2
D-37070 Gottingen
Germany
Tel +49 0551 905 0
Fax +49 0551 905 777

CALMASTER HELPLINE
Email : calmaster@gb.abb.com or calmaster@us.abb.com

QSTA1138 Iss. 9

CERTIFICATE OF CALIBRATION

QSTA Issue 2

World Flow Tecnnology Centres

ABB

ABB Automation
Oldends Lane, Stonehouse
Gloucestershire, GL10 3TA, ENGLAND
Tel: +44 (0) 1453 826661
Fax: +44 (0) 1453 821121
e-mail: flow@gb.abb.com

ABB Automation Inc.
125 East Country Line Road
Warminster, PA 18974 U.S.A.
Tel: +1 215 674 6000
Fax: +1 215 674 6394

ABB Automation
P.O. Box 2083
Taren Point NSW 2229 AUSTRALIA
Tel: +61 2 540 0000
Fax: +61 2 540 0001

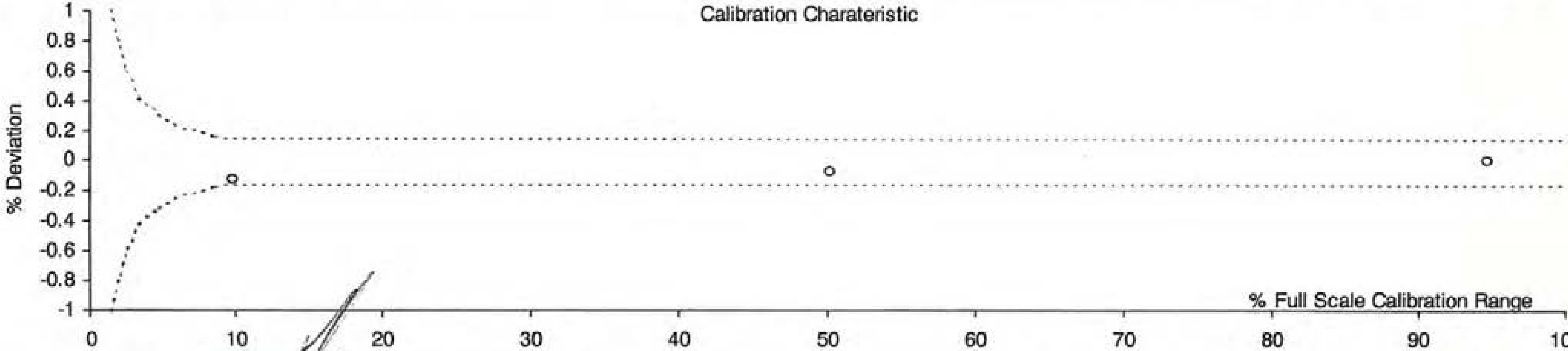
ABB Automation GmbH
Dransfelder Str. 2
D-37079 Goettingen GERMANY
Tel: +49 (0) 551 905212
Fax: +49 (0) 551 905711

Customer name: ABB AUSTRALIA PTY LTD
Customer ref. : 5145943
Serial number : P/26949/3/5
Order reference : EXP/P/26949/NKM
Meter type : MagMaster
Tag Number :

Meter code : MF/F351Z4110A005ER1301111
Calibration output : Digital
Customer full scale : 300.000 l/s
Calibration range : 500.00 l/s
Meter bore : 350 mm

Certificate number : 04/55733
Date of calibration : 11 Mar 2004
Test plant : Rig 9 9000m³/h
Sensor factor 1 : 1.4035
Sensor factor 2/3/4: 2 / 5 / 1.0000
Transmitter No : vkh06125

		Reference								Meter Under Test		
Test Run number	Run Time sec	Water Temp °C Int	Ext	Stream 1 l/s	Stream 2 l/s	Stream 3 l/s	Stream 4 l/s	Stream 5 l/s	Total Flow l/s	Flowrate l/s	% Cal. range	% Error
1	300	19.6	19.6	412.777	0	0	60.277	0	473.054	473.07	94.6	0
2	300	19.6	19.5	219.661	0	0	31.090	0	250.751	250.575	50.1	-0.07
3	300	19.4	19.6	0	0	0	49.181	0	49.181	49.122	9.8	-0.12



Calibrator ABB SKRJ 402 KT

Approved by ABB 405 KT

Witnessed by

Page 1 of 1

```
Printed Output From File
"G:\SERVIC~1\CALIBR~1\FACTOR~1\QLD\HV
AC-H~1\2694935.MAG"
Program v1.00 (30/08/1999) (WIN-PC)
File Produced : 26/07/04 9:28:56 AM

** Display Menu **
------------------
Display Mode       = 0
Display Resolution = 1

** Flow Menu **
---------------
Flow Range      = 600.00000
Flow Units      = Ltr
Flow Multiplier = x1
Flow Time       = s
Flow Response   = 3
Flow Probe Ins  = 1.00000
Flow Probe Prof = 1.00000
Flow Cutoff     = 3

** Analog Menu **
-----------------
Analog FSD     = 20
Analog Zero    = 4
Analog Dir Fwd = 1
Analog Dir Rev = 0
Analog No. 2   = 100.00000

** Pulse Menu **
----------------
Pulse Factor = 0.00999
Pulse Cutoff = 0
Pulse Max    = 800
Pulse Idle   = 1
Pulse Size   = 0

** Totaliser Menu **
--------------------
Totaliser Units      = Ltr
Totaliser Multiplier = k
Totaliser Clear Enab = 0

** Alarm No.1 Menu **
---------------------
Alarm No.1 Idle     = 1
Alarm No.1 Enable   = 1
Alarm No.1 Fault    = 1
Alarm No.1 Forward  = 0
Alarm No.1 Reverse  = 0
Alarm No.1 Cutoff   = 0
Alarm No.1 MtSensor = 1
Alarm No.1 Hi       = 0
Alarm No.1 Lo       = 0
Alarm No.1 Analog   = 0
Alarm No.1 Pulse    = 0

** Alarm No.2 Menu **
---------------------
Alarm No.2 Idle     = 1
Alarm No.2 Enable   = 1
Alarm No.2 Fault    = 0
Alarm No.2 Forward  = 0
Alarm No.2 Reverse  = 1
Alarm No.2 Cutoff   = 0
Alarm No.2 MtSensor = 0
Alarm No.2 Hi       = 0
Alarm No.2 Lo       = 0
Alarm No.2 Analog   = 0
Alarm No.2 Pulse    = 0

** Alarm Trip Menu **
---------------------
Alarm Trip Hi   = 110
Alarm Trip Lo   = -110
Alarm Trip Hyst = 1
Alarm Trip Disp = 0

** Input Menu **
----------------
Input Clr
Input Idle  = 0

** MtSensor Menu **
-------------------
MtSensor Trip = 50

** Sensor Menu **
-----------------
Sensor Number     = P/26949/3/5
Sensor Tag        = 5428814
Sensor Size       = 350
Sensor FACTOR 1 = 1.40352
Sensor FACTOR 2 = 2
Sensor FACTOR 3 = 5
Sensor FACTOR 4 = 1.00000

<<== END OF FILE ==>>
```

Oy Grundfos Environment Finland Ab
ADDRESS: Kaivokselantie 3-5, FIN-01610 VANTAA TEL: +358-9-561420

GRUNDFOS

Pump	**S21154M3B513ZB93**
SAP	96553681
Duty	**180 l/s x 39 m**

Test Report for Pump

ISO 9906 Grade 2

Verification of duty point

GRUNDFOS

Customer :

Order No. :

Date of test : 15.10.2004 17:13

Tester : V7186186 **Operator :** JSA

Serial No. : 965536810182521 **SAP-Code :** 96553681

Pump type :

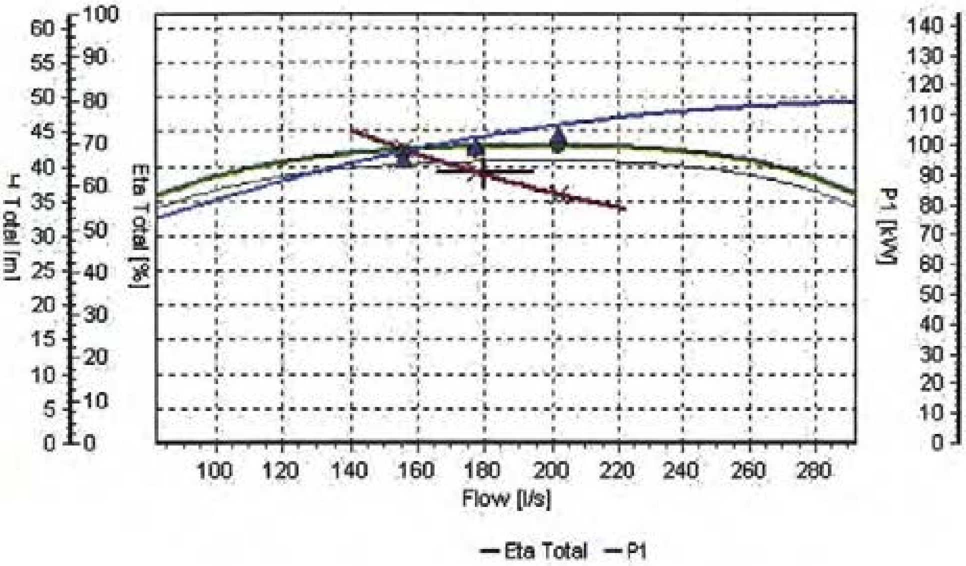
Customer request :

	Flow (l/s)	Head (m)
Duty point	**180.00**	**39.00**

Oy Grundfos Environment Finland Ab
Kaivokselantie 3-5, Vantaa
P.O. Box 1036
Fin-00101 Helsinki
Phone: +358 9 561 420
Fax: +358 9 563 3989

Test results for serial no. : 965536810182521

	Flow (l/s)	Head (m)	U1 (V)	U2 (V)	U3 (V)	I avg. (A)	P1 (kW)	Eta (%)
Point 1	155.66	42.36	413	413	413	165.3	95.1	67.7
Point 2	177.66	38.94	413	413	413	171.7	99.5	68.2
Point 3	202.07	35.81	413	413	413	177.8	103.6	68.9



Page 2

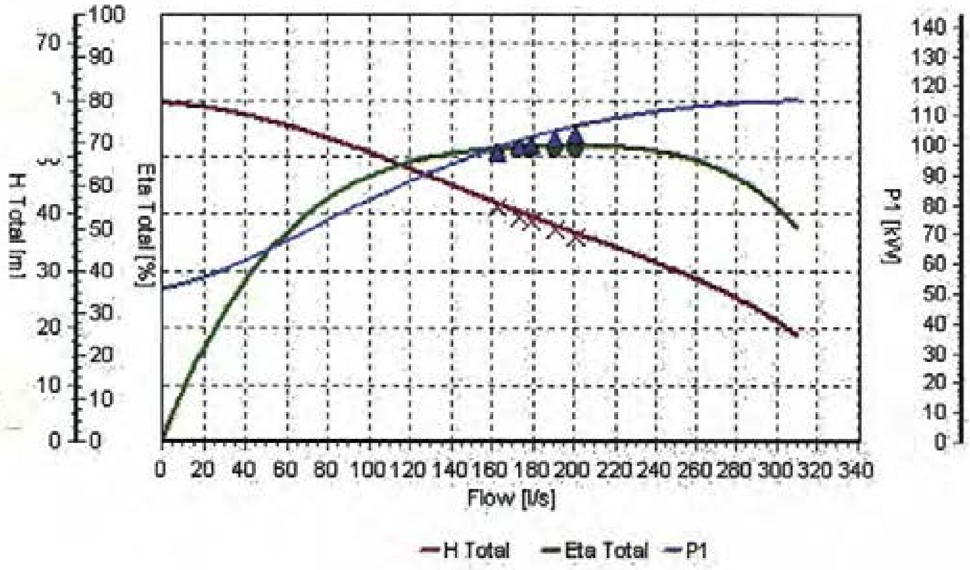
Test Report for Pump

Manual test procedure

GRUNDFOS

C_ _r No.:		Date of test :	15.10.2004 17:59
C_ _ator :	JSA	Tester :	V7186186
Serial no. :	96553681B182521	SAP-code :	96553681
Pump Type :			

	Flow (l/s)	Head (m)	U1 (V)	U2 (V)	U3 (V)	I avg. (A)	P1 (kW)	Eta (%)
Point 1	162.26	41.26	413	413	413	167.7	97.3	67.7
Point 2	173.69	39.46	413	413	413	171.1	99.2	67.9
Point 3	179.45	38.67	413	413	413	172.4	100.3	68.1
Point 4	190.57	37.39	413	413	413	175.5	102.4	67.9
Point 5	200.57	35.86	413	413	413	176.8	103.3	68.2



)y Grundfos Environment Finland Ab
:aivokselantie 3-5, Vantaa
P.O. Box 1036
Fin-00101 Helsinki
Phone: +358 9 561 420
Fax: +358 9 563 3989

Test Report for Pump

ISO 9906 Grade 2

Verification of duty point

GRUNDFOS

Customer :

Order No. :

Date of test : 15.10.2004 19:55

Tester : V7186186

Operator : JSA

Serial No. : 96553681A182522

SAP-Code : 96553681

Pump type :

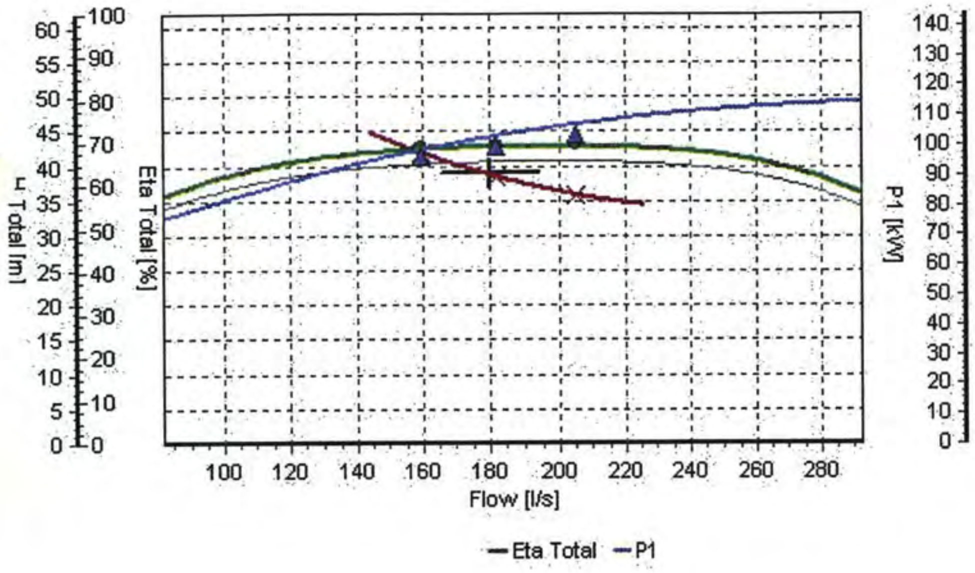
Customer request :

	Flow (l/s)	Head (m)
Duty point	**180.00**	**39.00**

Oy Grundfos Environment Finland Ab
Kaivokselantie 3-5, Vantaa
P.O. Box 1036
Fin-00101 Helsinki
Phone: +358 9 561 420
Fax: +358 9 563 3989

Test results for serial no. : 96553681A182522

	Flow (l/s)	Head (m)	U1 (V)	U2 (V)	U3 (V)	I avg. (A)	P1 (kW)	Eta (%)
Point 1	159.55	41.89	413	413	413	165.2	95.7	68.5
Point 2	181.43	38.51	413	413	413	170.4	99.6	68.8
Point 3	205.30	35.86	413	413	413	175.9	103.5	69.8



Page 2

Test Report for Pump

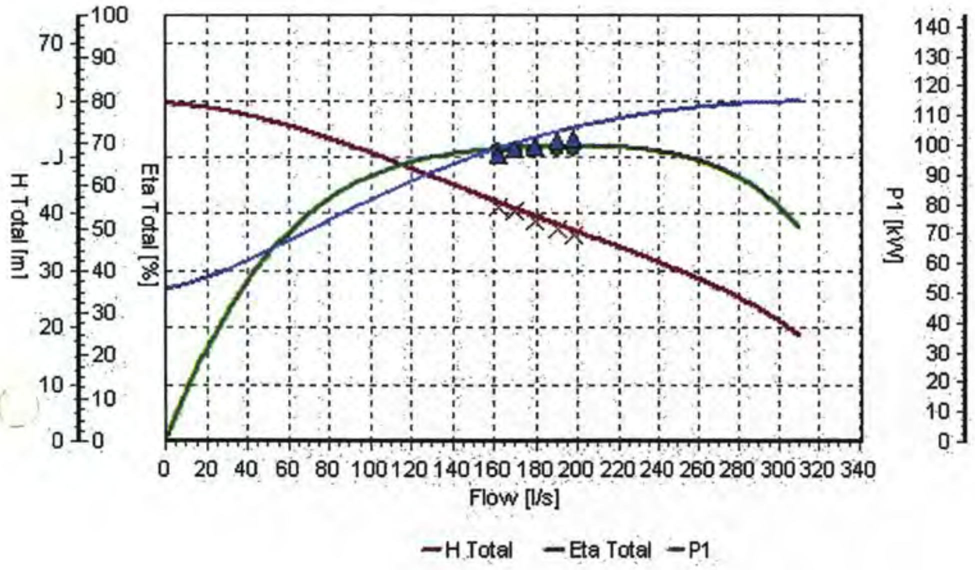
Manual test procedure

GRUNDFOS

Order No.:		Date of test :	15.10.2004 20:24
Operator :	JSA	Tester :	V7186186

Serial no. :	96553681B182522	SAP-code :	96553681
Pump Type :			

	Flow (l/s)	Head (m)	U1 (V)	U2 (V)	U3 (V)	I avg. (A)	P1 (kW)	Eta (%)
Point 1	161.99	41.16	413	413	413	166.6	96.4	68.1
Point 2	169.35	40.65	413	413	413	169.3	98.7	68.1
Point 3	179.05	38.59	413	413	413	170.4	99.5	68.1
Point 4	190.30	37.38	413	413	413	173.7	101.7	68.5
Point 5	198.07	36.19	412	413	413	174.5	102.1	68.7



Oy Grundfos Environment Finland Ab
Kaivokselantie 3-5, Vantaa
P.O. Box 1036
Fin-00101 Helsinki
Phone: +358 9 561 420
Fax: +358 9 563 3989

Test Report for Pump

ISO 9906 Grade 2

Verification of duty point

GRUNDFOS

Customer :

Order No. :

Date of test : 16.10.2004 8:00

Tester : V7186186 **Operator :** JUN

Serial No. : 965536810182523 **SAP-Code :** 96553681

Pump type :

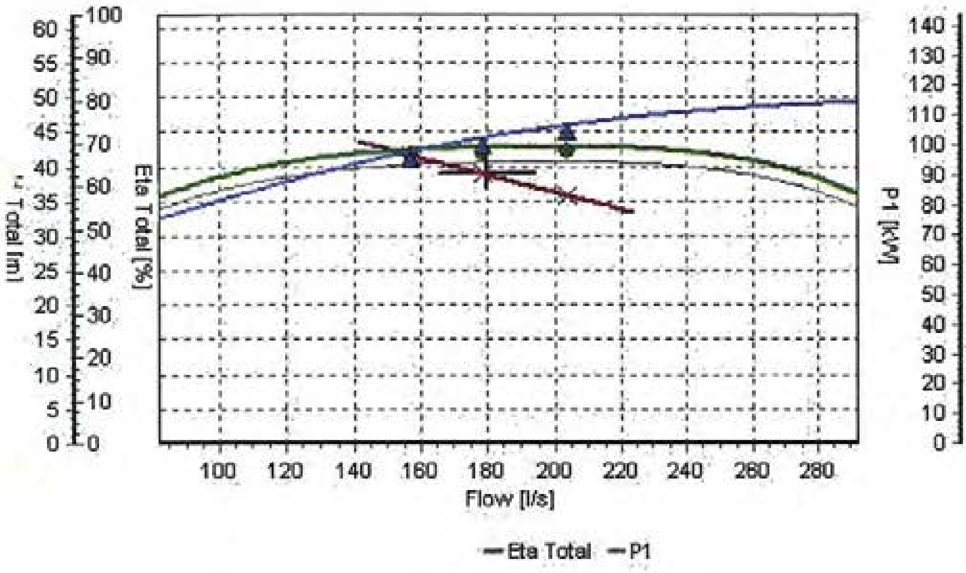
Customer request :

	Flow (l/s)	Head (m)
Duty point	**180.00**	**39.00**

Oy Grundfos Environment Finland Ab
Kaivokselantie 3-5, Vantaa
P.O. Box 1036
Fin-00101 Helsinki
Phone: +358 9 561 420
Fax: +358 9 563 3989

Test results for serial no. : 965536810182523

	Flow (l/s)	Head (m)	U1 (V)	U2 (V)	U3 (V)	I avg. (A)	P1 (kW)	Eta (%)
Point 1	157.07	41.55	413	413	413	165.1	95.2	67.4
Point 2	178.37	38.89	412	413	413	171.5	100.2	67.8
Point 3	203.63	35.77	413	413	413	178.0	104.6	67.9



Page 2

Test Report for Pump

Manual test procedure

GRUNDFOS

O. .r No.:

C. ator : JUN

Date of test : 16.10.2004 08:44

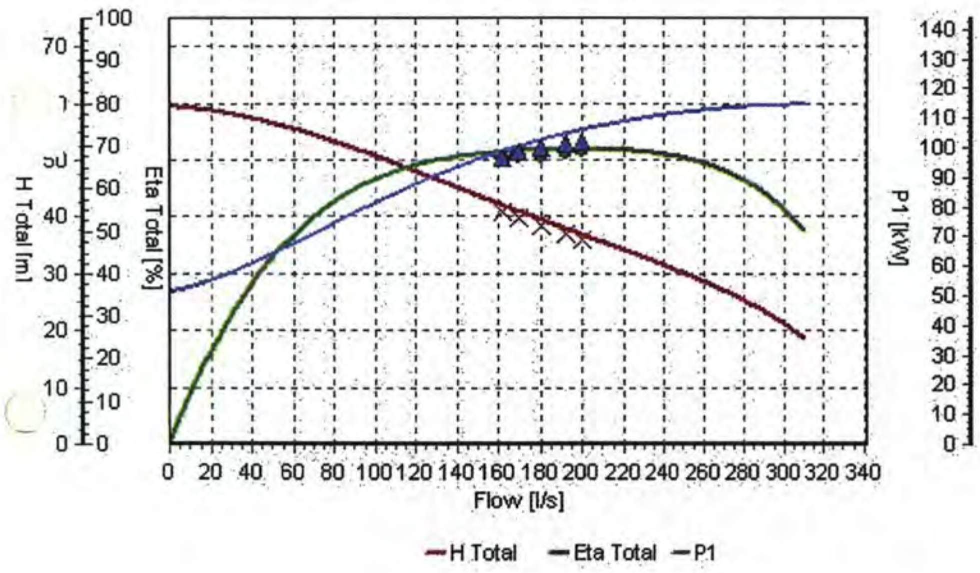
Tester : V7186186

Serial no. : 96553681B182523

SAP-code : 96553681

Pump Type :

	Flow (l/s)	Head (m)	U1 (V)	U2 (V)	U3 (V)	I avg. (A)	P1 (kW)	Eta (%)
Point 1	162.00	40.69	412	413	413	166.3	96.5	67.2
Point 2	169.35	39.96	412	413	413	169.0	98.4	67.6
Point 3	180.47	38.32	413	413	413	172.1	100.4	67.8
Point 4	191.90	37.00	413	413	413	173.3	101.5	68.5
Point 5	199.33	36.00	413	413	413	175.1	102.4	69.1



Oy Grundfos Environment Finland Ab
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P.O. Box 1036
Fin-00101 Helsinki
Phone: +358 9 561 420
Fax: +358 9 563 3989

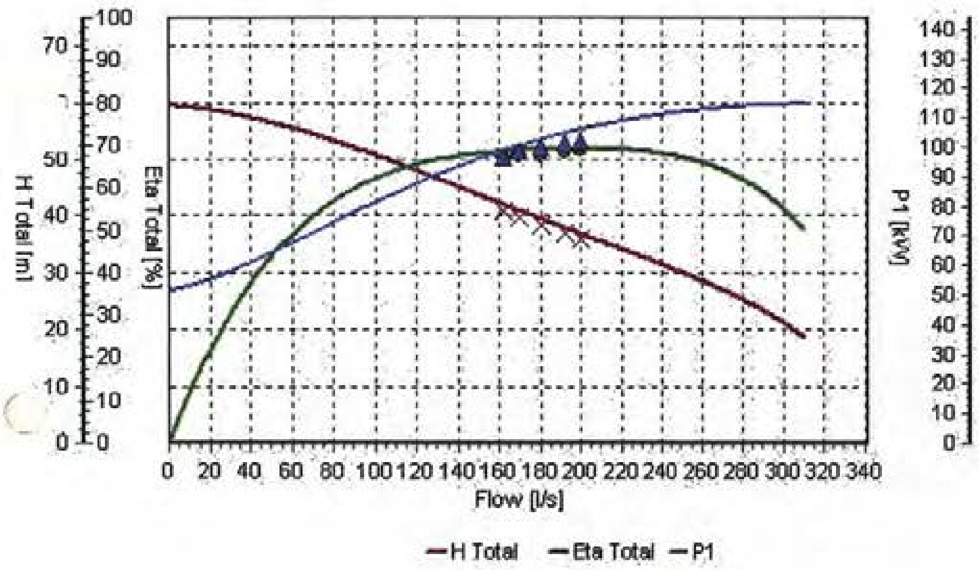
Test Report for Pump

Manual test procedure

GRUNDFOS

O· ·r No.:		Date of test :	16.10.2004 08:44
C,-..ator :	JUN	Tester :	V7186186
Serial no. :	96553681B182523	SAP-code :	96553681
Pump Type :			

	Flow (l/s)	Head (m)	U1 (V)	U2 (V)	U3 (V)	I avg. (A)	P1 (kW)	Eta (%)
Point 1	162.00	40.69	412	413	413	166.3	96.5	67.2
Point 2	169.35	39.96	412	413	413	169.0	98.4	67.6
Point 3	180.47	38.32	413	413	413	172.1	100.4	67.8
Point 4	191.90	37.00	413	413	413	173.3	101.5	68.5
Point 5	199.33	36.00	413	413	413	175.1	102.4	69.1



›y Grundfos Environment Finland Ab
..aivokselantie 3-5, Vantaa
P.O. Box 1036
Fin-00101 Helsinki
Phone: +358 9 561 420
Fax: +358 9 563 3989

GRUNDFOS

ELECTRIC MOTOR TEST REPORT

Pump manufacturer:		OY GRUNDFOS ENVIRONMENT FINLAND AB
Pump ordered by:		Grundfos Pumps PTY.LTD
Purchase order no:		79353
Manufacturers order no.:		114645
Items:		
	Motor:	HU195071A13ZB93
	Pump:	S21154M3B513ZB93
	Serial no.	182521

This certifies that the motors have been tested in production process as follows:

- Tightness of the motor, testing pressure 0.8 bar
- Dielectric test
- Insulation resistance test
- Earth continuity test
- Idle current test
- Protection device circuit.

Result of work test measurement: Motor has passed the tests

Vantaa, Finland 18/10/2004

OY GRUNDFOS ENVIRONMENT FINLAND AB

GRUNDFOS

ELECTRIC MOTOR TEST REPORT

Pump manufacturer:		OY GRUNDFOS ENVIRONMENT FINLAND AB
Pump ordered by:		Grundfos Pumps PTY.LTD
Purchase order no:		79353
Manufacturers order no.:		114645
Items:		
	Motor:	HU195071A13ZB93
	Pump:	S21154M3B513ZB93
	Serial no.	182522

This certifies that the motors have been tested in production process as follows:

- Tightness of the motor, testing pressure 0.8 bar
- Dielectric test
- Insulation resistance test
- Earth continuity test
- Idle current test
- Protection device circuit.

Result of work test measurement: Motor has passed the tests

Vantaa, Finland 18/10/2004

OY GRUNDFOS ENVIRONMENT FINLAND AB

GRUNDFOS

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Result of work test measurement: Motor has passed the tests

Vantaa, Finland 18/10/2004

OY GRUNDFOS ENVIRONMENT FINLAND AB

GRUNDFOS

HYDROSTATIC PRESSURE TEST REPORT

Pump manufacturer:	OY GRUNDFOS ENVIRONMENT FINLAND AB
Pump ordered by:	Grundfos Pumps PTY.LTD
Purchase order no:	79353
Manufacturers order no.:	114645
Pump Type:	S21154M3B513ZB93
SAP Code	96553681
Serial no.	182521
Volute Casing No.	13709A

This certifies that the volute casing has been type tested with water as follows:

Pressure:	10.5 bar
Holding time:	5 minutes.

Result: Neither leakage nor breaks have been found at visual examination.

Vantaa, Finland 18/10/2004

OY GRUNDFOS ENVIRONMENT FINLAND AB

GRUNDFOS

HYDROSTATIC PRESSURE TEST REPORT

Pump manufacturer:	OY GRUNDFOS ENVIRONMENT FINLAND AB
Pump ordered by:	Grundfos Pumps PTY.LTD
Purchase order no:	79353
Manufacturers order no.:	114645
Pump Type:	S21154M3B513ZB93
SAP Code	96553681
Serial no.	182522
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Holding time:	5 minutes.

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Vantaa, Finland 18/10/2004

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HYDROSTATIC PRESSURE TEST REPORT

Pump manufacturer:	OY GRUNDFOS ENVIRONMENT FINLAND AB
Pump ordered by:	Grundfos Pumps PTY.LTD
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Pump Type:	S21154M3B513ZB93
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Vantaa, Finland 18/10/2004

OY GRUNDFOS ENVIRONMENT FINLAND AB

Heroes Avenue Sewage Pumping Station
Functional Specification

1. Introduction

1.1 Scope of Document

This document outlines the functional requirements for the control, monitoring and telemetry of the sewage pumping station incorporating the Variable Speed Drives (VSD's), the switchboard and instrumentation.

The control circuitry for the pumping station is shown on drawings 486/5/7-LI010 to LI018 inclusive and this document should be read in conjunction with these drawings. The drawing list is contained in attachment 1.

All figures relating to flow rates and pump kW ratings are indicative only and may vary depending on the equipment selected by the Contractor and accepted by the Principal.

1.2 Purpose and Scope of Upgrade

The capacity of the existing Heroes Avenue Pump Station has been exceeded. The pumps are able to deliver 2.9xADWF before surcharging, which is below the Brisbane Water design standard of 4xADWF. This has resulted in the potential for unacceptable overflows from the pump station.

In addition, there have been increased odour complaints received from residents in the areas around the pump station. The odour issues are most likely related to the large wet well volume changes associated with the current start/stop operation, whereby H_2S is released via the vent.

The upgrade involves increasing the capacity of the pump station, minimising odour generation and redirection of flows from the S2 catchment to the S1 catchment via a new rising main along Coronation Drive.

It is intended to upgrade the existing Heroes Avenue wet well and install new pumps in the existing dry well and controls in the existing structure. The existing dry well pump station structure shall be retained to house the switchboard and the new pumps. The existing pumps and valves, switchboard, resistor banks and RTU cabinet shall be de-commissioned and removed to make way for the new equipment~~switchboard~~.

1.3 Heroes Avenue Pump Station Overview

The proposed refurbished sewage Pumping Station will be an underground conventional sewage pumping station with an existing Average Dry Weather Flow (ADWFe) of 52 l/sec, ultimate ADWFu of 75l/sec and an average operating wet well volume of 34 kl. The pump station will have three sewage pumps installed in the Pump Dry Well operating with two duty and one standby unit. The pumps will be interlocked so that only two pumps can operate at any time. The station output with one pump operating at minimum speed will be approximately 60 l/sec, and with two pumps operating at maximum speed will be approximately 360 l/sec under wet weather conditions.

2. Pump Station Operation

~~1.1~~2.1 Overview

The pump station will normally operate with the Pump Station Selected to Remote Auto mode. This enables the PLC to start and stop pumps and vary the operating speed, in response to the wet well level. When the Pump Station Selector Switch is in Local, the pumps can be started or stopped by using the local Start/Stop push buttons mounted on the switchboard. If the Pump Station is selected to Remote Manual from the Network Control Room Graphic Display at Cullen Avenue, the pumps can be started and stopped by the operator at Cullen Avenue. In all modes of operation the pumps will only be controlled by the PLC.

Normally only one pump will operate at any time, (however during times when the flow into the wet well exceeds the capacity of one pump, two pumps will operate~~two pumps will run at the same time as required depending on flow into the wet well~~).

When the wet well level reaches a predetermined level, the Duty 1 Pump is started, provided it satisfies all the enabling conditions.

If the wet well level reaches a high value, the Duty 2 Pump is started provided it satisfies all its enabling conditions.

Both pumps will also operate together at 50Hz daily to provide a total flow of at least 360 l/sec for slime stripping purposes.

~~1.2~~2.2 Pump Station Control

The pump station will operate in three modes as follows:

- Remote Auto Mode
- Remote Manual Mode
- Local Manual Mode

These modes will be selectable via a local/remote selector switch mounted on the switchboard, and a Remote Auto/Remote Manual software selection at Cullen Avenue.

When Remote Auto is selected, the control of the pump station will be based on the current state of the sewage wet well level with the station operating on a Dduty 1 Duty 2/Standby/~~standby~~ configuration.

When Remote Manual is selected, the operators at Cullen Avenue can start and stop pumps from the Graphic Display.

When the pump station is in Local Manual mode, the pumps can be started or stopped via local start/stop pushbuttons mounted on the switchboard. (Note: the local controls are wired to the PLC and all modes of operations are via the PLC only).

~~1.3~~2.3 Pump Duty Selection

The Pump Duty Selection function will monitor the availability of every pump on the site and control the rotation of the pumps for the multiple pump configuration.

In the multiple pump configuration, parallel operation of pumps will be permitted, ie a maximum of two pumps can operate at the same time. Under no circumstances shall the PLC permit all three pumps to operate together. The first duty pump will be the "Duty 1 Pump", the next duty pump will be the "Duty 2 Pump" and the third pump will be the "Standby Pump".

Initially the pump duty shall be:

Pump 1	Duty 1
Pump 2	Duty 2
Pump 3	Standby

After slime stripping, the duty shall rotate as follows:

Pump 1	Standby
Pump 2	Duty 1
Pump 3	Duty 2

Again after slime stripping the duty shall rotate as follows:

Pump 1	Duty 2
Pump 2	Standby
Pump 3	Duty 1

The daily rotation (after each slime stripping operation) shall continue as described above. The tables above define the three possible duty selections for the pump. Upon PLC power-up, pump 1 shall be the Duty 1 Pump.

If Slime Stripping is disabled or is skipped due to a wet weather event (see section 2.4.2), or an Auto Mode Level Transmitter Failure (see section 2.4.1), the pump duty shall rotate as the slime stripping is due to commence.

If the operator requests the standby or the Duty 2 pump to operate, it shall become the Duty 1 Pump and start if the start-up conditions as described in section 3.3 are met.

~~1.4~~2.4 *Pump Station Remote Auto Control*

When the Pump Station is in Remote Auto mode, the pumps shall be controlled such that the pump station output for one pump shall be between approximately 60 l/sec (minimum) to approximately 260 l/sec (maximum). When two pumps operating and the wet well level is approaching surcharge level, the station output shall be increased to at least 360 L/sec.

Control of the pump station will be based on the current state of the wet well level with the pumps operating in a Duty 1/Duty 2/Standby configuration. Under normal conditions, with the wet well rising and the wet well level signal valid, the site will operate in a level mode affected by a Proportional/Integral/Derivative (PID) Controller that will reside in the PLC.

The wet well level set points will be as follows:

Wet Well Level	**Function**
-5.0~~3.82~~ mAHD	Stop Duty 1 Pump
-2.0~~2.50~~ mAHD	Stop Duty 2 Pump
-4.4~~2.00~~ mAHD	Start Duty 1 Pump
-2.29~~2.00~~ mAHD	Set point
-1.6~~1.70~~ mAHD	Start Duty 2 Pump
-0.2~~1.50~~ mAHD	Slime Stripping Fill Level
0.05~~0.31~~ mAHD	Surcharge Imminent Alarm (Level Switch)

The duty pump will be requested to start at minimum speed (25 Hz, this speed will be a set constant and will be used in all Auto PLC controlled conditions as the pump minimum speed) when the wet well level exceeds the start Duty 1 Pump level ~~(-2.00 m)~~. The pump will then operate under PID control to maintain level at the setpoint~~-2.0m~~. The pump speed shall be capable of varying from minimum speed of 25 Hz to deliver approximately 60 l/sec to maximum speed of 50Hz to deliver approximately 260 l/sec. The modulating PID control will continue until the Stop Duty 1 Pump level ~~(-3.82 m)~~ is reached.

Should the level rise to the Start Duty 2 Pump Set point ~~(-1.70 m)~~, the Duty 2 Pump shall start. The level controller shall then control both pumps at the same speed determined by the calculated PID speed to maintain level at the setpoint~~-2.0m.~~

Both pumps will continue to run until the wet well level drops to the Stop Duty 2 Pump level set point ~~(-2.50 m)~~ for a PLC adjustable time period of 30 seconds. At this point the Duty 2 Pump will ramp down to minimum speed and stop.

The Duty 1 Pump will continue to operate as described above. Should the wet well level fall to the Stop Duty 1 Pump Set point ~~(-3.82m)~~ after a PLC adjustable time period, the Duty 1 Pump shall ramp to minimum speed and stop.

If the Duty 1 Pump or Duty 2 Pump is not available for automatic operation, the standby pump shall operate in its place.

If the surcharge imminent alarm input fails to clear within a time determined by the surcharge imminent active timer (initially set to 120 seconds) an alarm shall be generated and sent to the operators SCADA system.

In the event that two pumps are required to start at the same time, there shall be a PLC adjustable time of 20 seconds between the starts. This shall typically occur after a wet well level instrument calibration, upon level transmitter failure or upon restoration of power after a power failure.

Pump start control will be temporarily inhibited while the Wet Well level Instrument Calibration Check is in progress (refer Section 4.2.2).

~~1.1.1~~2.4.1 *Auto Mode Level Transmitter Failure*

In the event of a failure of the wet well level probe, the operating pump or pumps shall continue to operate at the last calculated speed. Should the surcharge imminent alarm become active the Duty 1 and Duty 2 Pumps shall start (if they are not already operating) and operate at full speed, and a surcharge imminent alarm shall immediately be sent to the operator. The pumps shall continue to operate until the level falls below the surcharge imminent electrode for a period of 30 minutes~~low level switch~~, at which point both pumps shall ramp to minimum speed and stop.

~~1.1.2~~2.4.2 *Slime Stripping*

The Heroes Avenue Sewage Pumping Station shall operate ~~in conjunction with the Hockings Street Pump Station~~ to achieve slime stripping of the sewer main. At a daily preset time, adjustable from the SCADA system, the wet well shall be allowed to fill to the Slime Stripping Fill Level ~~(-1.5m)~~. This shall be achieved by changing the PID level setpoint to the Slime Stripping Fill Level. ~~A signal shall be sent via telemetry to the Hockings Street RTU to indicate Slime Stripping is to begin. Upon receipt of this signal, the Hockings Street syphon mode of operation shall stop, allowing the wet well to fill.~~

~~Once the Hockings Street wet well is at the Slime Stripping Fill Level setpoint, a Hockings Street pump shall start and also send a signal via telemetry to the Heroes Avenue Pump Station RTU. At this point,~~ Once the level has risen to the slime stripping start setpoint the Duty 1 and Duty 2 Pumps shall be operated at maximum speed. The pumps shall continue to operate for a preset time, adjustable at the SCADA, or until the Stop Duty 1 Pump Level ~~(-3.82m)~~ is reached. When the slime stripping is complete, the Duty 1 Pump shall stop and the Duty 2 Pump becomes the Duty 1 Pump as described in section 2.3.

There shall also be a SCADA selection to allow for Slime Stripping to be Enabled or Disabled for each pump station. ~~If Slime Stripping is Enabled at both pump stations, the above sequence shall occur as described. If Slime Stripping is Disabled at Heroes Avenue, the Heroes Avenue RTU shall transmit a signal to the Hockings Street RTU to allow Hockings Street to perform a Slime Stripping Sequence. If Slime Stripping is Disabled at Hockings Street the above sequence shall occur as described except Heroes Avenue shall not wait for a Hockings Street pump to start. As soon as the wet well level at Heroes Avenue reaches the Slime Stripping Fill Level, the Heroes Avenue Pumps shall operate as described above to achieve Slime Stripping.~~

If the Slime Stripping has not completed after one hour, the sequence shall be aborted and ~~both Heroes Avenue and Hockings Street~~ the Pump Stations shall revert to the normal mode of operation and an alarm shall be generated.

The Slime Stripping shall not be permitted to occur during a wet weather event. If the calculated Wet Well inflow, as determined in Section 4.1.7, is above 150 l/sec~~, or if a Hockings Street pump is operating the~~

~~Slime Stripping~~ in which case slime stripping shall be skipped and ~~shall be skipped and~~ an alarm generated. Similarly if there is an Auto Mode Level Transmitter Failure (See section 2.4.1), Slime Stripping shall be skipped and an alarm generated.

Using manual valves, Heroes Avenue Pump Station can be configured to pump into the Indooroopilly Rising Main. If this mode of operation is implemented then Slime Stripping should be Disabled from Cullen Avenue as the Slime Stripping is targeted at the Coronation Drive Rising Main. When Heroes Avenue Pump Station is configured to the Coronation Drive Rising Main, Slime Stripping may be Enabled again.

~~1.1.3~~2.4.3 *PID Controller*

The PID controller shall be executed in the PLC. The set point, control terms (proportional, integral and derivative), Auto/Manual and manual output shall all be adjustable by technical staff only. A bumpless transfer shall be achieved in transferring from auto to manual or manual to auto.

~~1.1.4~~2.4.4 *Well Washing*

At a daily preset start time, adjustable from the SCADA system, a well washing sequence shall be executed. The washing solenoid valve shall open to spray fresh water on the well walls. This shall continue for a preset duration, adjustable from the SCADA. This ~~sequence shall be monitored by an inline flow~~ switch, located in the water supply line ~~after the solenoid~~. If water flow is not detected after a PLC adjustable time of 20 seconds, a flow low alarm shall be raised. The washing sequence shall continue until the duration timer has expired, even if the flow low alarm is active. If flow is detected after the well washing sequence is completed, after a PLC adjustable time of 20 seconds, a solenoid failed to close alarm shall be raised.

The well washing sequence shall also be initiated at the completion of slime stripping and after a wet well level instrument calibration.

2.5 *Backup Power Supply*

The pumpstation~~switchboard~~ shall normally have a ~~facility for connection of a~~ portable standby generator on site. The transfer from normal supply to generator supply shall be via the automatic transfer changeover panel~~manual transfer switch. The generator connection point shall be external to the building.~~ Upon power supply failure, the PLC on board the generator will start the generator and activate the changeover switch to continue to supply power to the pump station.
The standard Brisbane Water RTU configuration shall provide battery backup to the RTU.

3. Pump Station Functional Requirements

~~1.1~~3.1 *Pump Station Equipment*

The Heroes Avenue Pumping Station comprises the following equipment and instrumentation:

- Two Duty and one Standby 125 kW Raw Sewage Pumps No 1,2 and 3
- Wet well level transmitter type: submersible Vega probe with a Vega Level Monitor located in the RTU Cabinet.
- "Surcharge imminent" Multitrode type level probe with the relay mounted in the RTU Cabinet.
- "Pump Station Dry Well Flooded" Multitrode type level probe with the relay mounted in the RTU Cabinet.
- Sump pump Multitrode type level probe with the relay mounted in the RTU cabinet.
- Pump Discharge Pipe: Vega probe with a Vega Pressure Monitor located in the RTU cabinet.
- Rising Main: Magnetic type Flowmeter.
- Magnetic flow transmitter located in the RTU cabinet. Note: Interposing relays/pull-up resistors shall be provided, if required, for pulse and fault inputs.
- Variable Speed Drives VSD1, VSD2 and VSD3 shall be sized to suit the pumps and shall be Danfoss 6000 series

- Reflux Valve Limit Switches.
- Emergency Stop on the MCC.
- Emergency Stop at each Pump.
- Pump Station Local/Remote Selector Switch mounted in the Switchboard.
- RTU and PLC located in the Switchboard.
- Pump Motor Power Transducer.
- Pump Motor Current from the VSD.
- Well washer solenoid valve with flow switch.
- Dry well ventilation fan. (Existing)
- Dry well sump pump. (Existing)
- Site Attention Alarm situated inside the Dry Well Structure. (Existing)
- Satec C191HM Power Monitor on Incoming supply
- Two single phase and one three phase GPO's in the Pump station~~Switchroom~~

~~1.2~~3.2 Signals

A brief description of each fault signal is given below:

~~1.1.1~~3.2.1 Pump Station Power Available

If a "Station Power Failure" signal (provided by Power Failure Relay – PFR) is detected from the site, an alarm will be generated after a PLC adjustable time period has elapsed. This will make all pumps unavailable for PLC control. The alarm will be monitored at Cullen Avenue. The pumps shall become available if the power has been restored for a PLC adjustable time, initially 30 seconds (of sufficient duration for the VSD's to power up and be ready for operation).

During a power failure period, all alarms from the drive controls shall be inhibited to prevent nuisance alarms. Level alarms shall continue to be monitored.

~~1.1.2~~3.2.2 Pump Thermal Overload Fault

The pump thermal overload protection shall be incorporated in the pump VSD. If a thermal overload is detected by the VSD, the VSD warning signal to the PLC will be on and the VSD will keep running the pump at a reduced load. If the thermal overload exceeds a preset limit in the VSD, then the pump will be stopped by the VSD and the VSD Ready signal to the PLC will be off. This will make the pump unavailable for PLC control until the fault has cleared and the VSD has been reset (Refer to Pump VSD Fault in Section 3.2.5).

~~1.1.3~~3.2.3 Pump Thermistor Fault

The motor thermistors will be wired to the VSD and the VSD will provide protection for the pump motor.

With station power available, the presence of a pump motor thermistor fault signal will cause the VSD to provide a Warning signal to the PLC and the VSD will keep running the pump at a reduced load. If the thermistor fault signal persists for more than a preset time (set in the VSD), then the pump will be stopped by the VSD and the VSD Ready signal to the PLC will be off. This will make the pump unavailable for PLC control until the fault has cleared and the VSD has been reset (Refer to Pump VSD Fault in Section 3.2.5).

~~1.1.4~~3.2.4 Pump Bearing Thermistor Fault

The lower bearing thermistor shall be connected to a thermistor relay to provide protection for the pump bearings.

With station power available, the presence of a bearing thermistor fault signal will cause the pump to stop. This will make the pump unavailable for operation until the fault has cleared by pressing the local reset pushbutton.

~~1.1.~~53.2.5 *Pump VSD Ready and In Auto Mode*

Each of the three sewage pumps at the Heroes Avenue Pumping Station will be driven by its own VSD. The local control keypad for each VSD will be mounted on the switchboard. The following control functions are available on the keypad:

- When the VSD is selected to Local mode, the speed can be adjusted from the potentiometer located on the switchboard door.
- When the VSD is selected to Auto mode, it will be controlled via the remote signals coming to the VSD with all local control signals being inactive.

The following VSD signals will be connected to the pump station PLC:

- "VSD Warning" PLC digital input signal: this signal will be on when the VSD is powered up and it detects one of the following listed faults:
  - Mains Imbalance.
  - Overvoltage or Undervoltage.
  - Inverter Overloaded.
  - Motor Thermal Overload.
  - Motor Thermistor Fault.
  - Overcurrent.

  When the VSD Warning signal is detected, the VSD will run the pump at a reduced load to let the motor recover and the fault to clear. If the fault does not clear within a time period set in the VSD, then the pump will be tripped by the VSD and the "VSD Ready" PLC input signal will be off.

- "VSD Ready" PLC digital input signal: this signal will be on when the VSD is powered up and the following conditions are not present:
  - One of the VSD Warning signals listed above has not tripped the pump.
  - One of the VSD essential faults has not been detected. The VSD Essential faults are:
    a) Earth Fault.
    b) Switch Mode Fault.
    c) Short Circuit.
    d) Auto-optimisation not OK.
    e) Heat-sink Temperature Too high.
    f) Motor Phase Failure.
    g) Inverter Fault.

  If any one of these essential faults is detected, the VSD will stop the pump and the "VSD Ready" PLC input signal will be off.

- "VSD Auto mode Selected" this signal will be on if the drive is selected to Auto on the keypad and is ready for remote control.

- "VSD Running" this signal will be on when the drive is running.

- "VSD Running Speed" PLC analog input signal will provide 4-20mA VSD running Hz to the PLC.

- When selected to Auto mode with the pump station mode selector switch in Remote, each Variable Speed Drive speed will be controlled via an analogue output from the PLC. The pump operating speed will be set by the PLC as explained in Section 2.4.

A VSD will be available for PLC control if the "VSD Ready" and "VSD Auto Selected" signals are on.

The pump "VSD Ready" fault will be unlatched and the pump will become available for PLC control if any of the following conditions are true:

i) The pump VSD Ready fault condition is reset (VSD Ready PLC input signal active) and the local reset push-button is pressed.
ii) The pump VSD Ready fault condition is reset (VSD Ready PLC input signal active) and a reset is issued from Cullen Avenue.
iii) The Pump VSD Ready reset delay timer times out. This will be indicated by the pump VSD Ready auto reset flag being active.

When the pump VSD resets, the VSD Auto reset timer will start. The VSD Ready delay reset timer is used to allow a preset time to pass before unlatching the fault.

~~1.1.6~~3.2.6 *Pump Station Dry Well Flooded*

A level switch, set above the normal operating level of the sump pump, monitors the water level in the Dry Well. Should this level switch be activated, a priority one alarm shall be generated immediately.

~~1.1.7~~3.2.7 *Pump VSD Fault Count Exceeded*

The maximum number of times a VSD Not Ready signal is permitted to trip and be re-set in any 8 (eight) hour period shall be adjustable from the SCADA. The selection shall be 0, 1, 2 or 3 (eg if 0 is selected, the pump shall lockout on the first trip). If the fault count gets up to the selected limit, a fault count exceeded flag will be set. This will lockout the pump and will make it unavailable for PLC control. The pump lockout will be cleared if one the following conditions are met:

i) The local pump fault reset push-button is pressed.
ii) The remote pump fault reset is issued form Cullen Avenue.

~~1.1.8~~3.2.8 *Pump Emergency Stop*

There are two emergency stop push-buttons for each sewage pump. One is mounted on the switchboard and the other is local to the pump at the base of the dry well. Upon detection of the operation of the Emergency Stop pushbutton via PLC digital input signals, the Pump Emergency Stop Flag will be latched on and the pump will be unavailable. If the station is in remote, the flag will remain latched on until the Emergency Stop pushbutton has been released and either the pump local reset pushbutton has been operated or the station is switched to local. If the station is in local the flag will remain latched on until the emergency stop pushbutton has been released.

The emergency stop pushbuttons shall be hard-wired to open the Isolating Contactor.

~~1.1.9~~3.2.9 *Pump Reflux Valve Failed*

The PLC will monitor the pump reflux valve microswitch digital input at all times.

The reflux valve microswitch contact states will be as follows:

Pump Stopped – Reflux Down and Reflux Microswitch Contact CLOSED.
Pump Running – Reflux Up and Reflux Microswitch Contact OPEN.

On pump startup, a PLC adjustable reflux microswitch timer of 30 second shall be started. If the reflux valve fails to open within this time period, then the reflux valve fail to open flag will be latched on and the pump shall stop and become unavailable for PLC control. If a pump is running and the reflux valve closes, after a PLC adjustable 30 second delay, then the reflux valve fail to open flag, will be latched on and the pump shall stop and become unavailable for PLC control.

The pump reflux valve fail to open fault will be unlatched if any of the following three conditions are true:

i) The local pump reset pushbutton is pressed.
ii) A reset from Cullen Avenue occurs.
iii) The pump reflux fail to open delay reset timer times out. This will be indicated by the pump reflux fail to open fault auto reset flag being active.

If a pump stops and the reflux valve fails to close within a set time period, an alarm "Pump Reflux Valve Closing Fault" will be generated. This condition will not cause the pump to become unavailable for PLC control. The closing fault will be cleared based on conditions i) and ii) above.

~~1.1.10~~3.2.10 Pump Reflux Valve Failed Count Exceeded

The maximum number of times the reflux valve is permitted to trip in any 8 (eight) hour period is adjustable from the SCADA. The selection shall be 0, 1, 2 or 3 (eg if 0 is selected, the pump shall lockout on the first trip). If the fault count gets up to the selected limit, a fault count exceeded flag will be set. This will lockout the pump and will make it unavailable for PLC control. The pump lockout will be cleared if one the following conditions is met:

i) The Local pump fault reset push-button is pressed.
ii) The Remote pump Fault reset is issued from Cullen Avenue.

~~1.3~~3.3 Pump Start/Stop Sequence

A sewage pump is deemed to be available when there is power to the site, there are no failures or faults, and any fault counters have not exceeded the defined limits.

An available pump is either running or can be started to run if the pump start conditions are met. If a pump becomes unavailable for PLC control, it will be stopped and prevented from starting until it becomes available again as detailed below.

A pump will be available for PLC control if the following conditions are met:

- Pump Station Power Available
- Pump VSD is Ready
- Pump VSD is in Auto Mode
- Pump VSD Fault Count Exceeded is Healthy
- Pump Emergency Stops are Healthy
- Pump Reflux Valve Failed is Healthy
- Pump Reflux Valve Failed Count Exceeded is Healthy

If any of these conditions are not met, then the pump is unavailable for PLC control and will not be able to be started automatically or locally via the local start push-button.

The pump individual control function monitors any request for the pump to start and/or stop. This results in the issuing of a start or a stop command to the pump.

The pump will start if all the following conditions are true:

i) The pump is available for PLC control.
ii) The pump is not locked out.
iii) The pump is requested to run.

The pump will stop if any of the following conditions are true:

i) The pump is requested to stop.
ii) The pump is no longer available for PLC control.

When the pumping station is switched to local mode, any running pump will be stopped and the PLC will perform no automatic pump controls until the station is returned to remote.

With the station in local, the pumps can be started via the "Start" pushbutton mounted on the switchboard. The pump will run until the "Stop" pushbutton is pressed.

The start-up sequence for a pump will be executed in the following manner:

- Wet well level transmitter signal reaches pump start set point (for the pump in Remote mode) or pump Start push-button is pressed (for the pump in Local mode).
- Energise the VSD Run/Stop relay. The VSD starts at minimum running speed (25 Hz), the VSD running relay changes state to indicate the pump is running. Set VSD rail to ramp timer at 30 secs delay (initially).
- Reflux Valve Limit Switch delay timer (0 – 30secs) is energised.
- If the Reflux Valve Limit Switch breaks before Reflux Valve Limit Switch delay timer expires, then the energised run relay remains energised.
- Pump running light on local panel is energised.

The stop sequence for a pump will be executed in the following manner:

- Wet Well Level is at the pump stop set-point (for the pump in Remote mode) or the Pump Stop Pushbutton is pressed (for the pump in Local mode).
- De-energise VSD Run/stop relay, VSD deceleration is initiated.
- Start reflux timer (0 – 60secs) delay.
- Once the VSD has ramped down to 0Hz, the VSD running signal will be inactive.
- Run light on local panel is de-energised.

The Emergency Stop sequence for a pump will be executed in the following manner:

- MCC Emergency Stop pushbutton is pressed.
- This will open the pump isolating contactor
- De-energise VSD Run/stop relay.
- Run light on local panel is de-energised.

4. PLC Functionality

~~1.1~~4.1 *RTU and PLC Alarms and Calculations*

The following is a summary of the alarms performed in the RTU:

i) RTU Power Fail Alarm.
ii) RTU Low Battery Alarm.

The following is a summary of the alarms and calculations performed in the PLC:

iii) Station Power Fail Alarm.
iv) Wet Well Level.
v) Wet Well Volume.
vi) Wet Well Monitor.
vii) Wet Well Inflow and Inflow Integration.
viii) Wet Well Overflow Volume.
ix) Wet Well Surcharge Probable Alarm.
x) Wet Well Surcharge Imminent Alarm.
xi) Wet Well Surcharge Occurrence Duration and Alarm.
xii) Flow Rate Conversion.
xiii) Delivery Flow Rate Monitor.
xiv) Flow Rate Integration.
xv) Pressure Measurement Conversion.
xvi) Delivery Pressure Monitor.
xvii) Pump Availability.
xviii) Pump Running.
xix) Pump Number of Starts.

xx) Pump Hours Run.
xxi) Pump Reflux Valve Failure.
xxii) Pump Variable Speed Drive Not Ready.
xxiii) Pump Variable Speed Drive Warning.
xxiv) Pump Emergency Stop
xxv) Plant Availability Index for Pumps.
xxvi) Plant Utilisation Index for Pumps.
xxvii) Hydraulic Power Consumption.
xxviii) Electrical Power Consumption.
xxix) Motor Current Monitor.
xxx) Motor Power Monitor.
xxxi) Motor Efficiency.
xxxii) Pump Not in Auto Mode.
xxxiii) Pump Running Speed.
xxxiv) Pump Speed Control.
xxxv) Well Washer Control.
xxxvi) Pump Blockage Alarm.
xxxvii) Pump Station Electrical Surge Protection Alarm

A brief description of each item is given below.

~~1.1.1~~4.1.1 RTU Power Fail Alarm

When a "RTU Power Failure" (derived from battery charger input under voltage) signal is detected from the site, an alarm will be generated after a pre-defined time period has elapsed.

~~1.1.2~~4.1.2 RTU Low Battery Alarm

When a "Battery LOW" signal is detected from the RTU battery, an alarm will be generated after a pre-defined time period has elapsed.

~~1.1.3~~4.1.3 Station Power Fail Alarm

Refer to section 3.2.1.

~~1.1.4~~4.1.4 Wet Well Level

The Wet Well level is derived from the standard 4-20mA analogue signal scaled in MAHD (Metres Australian Height Datum).

The level readings will be clamped and alarmed at the minimum and maximum levels of the level probe with a preset percentage variance. A filtered level will be calculated over a 5 by 5 second sampling periods.

~~1.1.5~~4.1.5 Wet Well Volume

The Wet Well Volume is derived from the Wet Well Level. The level is compared against an adjustable look up table that derives a volume based on level segment entries.

~~1.1.6~~4.1.6 Wet Well Monitor

The filtered wet well level will be checked for operator adjustable limits. At PLC initialisation the limits will be set to default values stored in the PLC.

~~1.1.7~~4.1.7 Wet Well Inflow and Inflow Integration

Flow into the wet well will be calculated using the wet well level. From the wet well level signal and using provided constants, the storage value (in cubic metres) for any wet well level can be determined. At constant specified periods an increase in storage capacity will be calculated for that period. The increase will be converted to litres per minute inflow value. This calculation will only occur when the pumps are not in operation.

During times when pumps are operating the inflow will be assumed to be equal to the outflow. This is due to the fact that the pumps shall operate on level control to maintain a fixed wet well level. Under steady state conditions (ie no change in wet well level) the outflow shall equal the inflow.

During Slime Stripping (filling and operation of the pumps), the inflow shall be clamped at the last calculated value prior to the start of Slime Stripping.

The measured inflow shall be integrated to give a cumulative total, in kilolitres (kl), of the flow through the sewage system site. The daily flows shall be used in reports.

Integration of the flow during periods where the Wet Well Level signal is determined to be invalid will use a zero value for Flow Rate.

~~1.1.8~~4.1.8 Wet Well Overflow Volume

The overflow volume shall be calculated during the overflow incident from the time that the level is above the overflow level and from the look-up table relating the volume flowing through the overflow to this height. The overflow volume shall be recorded for use in reports.

The overflow volume calculation shall be performed every 5 seconds when a surcharge is occurring.

~~1.1.9~~4.1.9 Wet Well Surcharge Probable Alarm

A "surcharge probable" alarm level will be generated when the predicted time to overflow is 30 minutes or less. The alarm calculation shall be initiated when the level in the wet well is above the Duty 2 pump start level for a PLC adjustable period of time and shall be reset when the wet well falls below this level.

The rate of change in level shall then be calculated over a rolling 5 minute period.

From the actual level in the wet well, the overflow level and the rate of change of level, a predicted time to overflow shall be calculated. If this time is less than 30 minutes, an alarm shall be generated.

This alarm shall be used to initiate an indication on the detail page of the time of day when the predicted surcharge will occur (ie. time of day of alarm plus predicted time until surcharge).

~~1.1.10~~4.1.10 Wet Well Surcharge Imminent Alarm

A "surcharge imminent" alarm will be generated when the "Surcharge Imminent" level switch, mounted 300mm below the overflow level is activated.

Note that the Surcharge Imminent Alarm is not raised if a Wet Well Calibration is in progress (refer to Section 4.2.32). This is due to the Calibration using the Surcharge Imminent Electrode as the sequence terminator.

Once activated, an alarm dead band shall maintain this alarm active for a minimum period of ten (10) minutes.

~~1.1.11~~4.1.11 Wet Well Surcharge Occurrence Duration and Alarm

A surcharge occurs when the sewage level is at or above a level 25mm below the overflow level. Once this alarm has been activated, an alarm dead band shall maintain this alarm for a minimum period of ten (10) minutes.

The surcharge incident duration shall also be calculated. The duration of a surcharge incident shall be defined as the time from which a "surcharge occurring" alarm becomes active until the same alarm becomes inactive. The beginning time and the end time of the surcharge incident shall be recorded for use in reports.

~~1.1.12~~4.1.12 Flow Rate Conversion

The flow rate is derived from standard 4-20mA analogue signal scaled in litres per second (l/sec). For the flow meter signal, a "Flow Rate Conversion" is performed to get the equivalent flow rate in kilolitres per day (kl/Day).

Flow rate readings will be clamped at the minimum and maximum flow rate of the flow meter range with a preset percentage variance.

~~1.1.13~~4.1.13 Delivery Flow Rate Monitor

The Delivery Flow Rate Alarm function will monitor flow rate signal from the Delivery Flowmeter. Flows beyond the alarm limits will cause alarms to be generated.

Separate high and low alarms shall be provided for each single and parallel pump combination.

The alarm limits used are:

i)	With one Pump running alone:	One Pump – High Flow Limit, and One Pump – Low Flow Limit.
ii)	With two Pumps running:	Two Pumps – High Flow Limit, and Two Pumps – Low Flow Limit.

The alarming for flow shall be inhibited when there are no pumps running to avoid nuisance alarms.

When a pump begins to run, has just stopped, is ramping from minimum speed as part of the startup or is ramping to minimum speed as part of a shutdown, the Flowmeter Inhibit Alarm Timer (set to 30 secs) shall begin timing. The alarming for flow shall be temporarily inhibited until after this timer expires.

~~1.1.14~~4.1.14 Flow Rate Integration

The pump station flow meter shall provide a pulse signal to the PLC to allow accurate flow integration. The PLC shall provide a total flow in kilolitres (kl).

The PLC shall calculate and retain total flow figures with sufficient significant figures for at least one year's operation.

Facilities shall be provided for the operator at Cullen Avenue to overwrite the calculated figures to correct errors. This includes the resetting of the total flow figure to zero.

The system shall also flag "invalid" readings due, for example, the loss of input signal from the associated flow meter or upon detection of a "Flowmeter Fault" PLC digital input signal. Invalid flow rate readings will not be included into the integration calculation. The total flow figure will, however, be flagged as "invalid".

The flow invalid signal will not be automatically reset after the flow rate signal comes good. All recorded data for the period that the flow rate input signal was invalid shall be flagged as "invalid" reading. The invalid signal will be reset after an updated value followed by an overwrite signal is applied to the volume figure or the volume figure is reset to zero.

At predefined periods the accumulated flow shall be reset to zero for accumulation calculations for the next period. (ie. Water flow meters will be reset once a year, where as sewage flow meters will be reset daily).

~~1.1.15~~4.1.15 Pressure Measurement Conversion

The Pressure measurements Conversion will calculate the equivalent pressure in kiloPascals (kPa) and Metres Above Australian Height Datum (MAHD). The field input shall be read as kPa.

Pressure readings will be clamped at the minimum and maximum pressure readings for the pressure gauge range with a preset percentage variance.

The pressure in kPa is required to be converted to Meters Water Gauge (MWG).

<u>Conversion to MWG</u>

Pressure kPa is converted to MWG by dividing by a conversion factor.

Pressure (MWG) = Pressure (kPa)/k

Where:

- Pressure (kPa) is the engineering units signal from the pressure transmitter in kPa units.
- Pressure (MWG) is the pressure in meters water gauge.
- k is the kPa to MWG conversion factor of 9.803.

<u>Conversion to MAHD</u>

The pressure MAHD is calculated by adding the elevation value of the pressure transducer to the pressure measurement.

Pressure (MAHD) = Pressure (MWG) + Ep (MAHD)

Where:

- Pressure (MWG) is the pressure in metre unit.
- Ep (MAHD) is the elevation of the pressure transducer.
- Pressure (MAHD) is the pressure in MAHD unit.

~~1.1.16~~4.1.16 *Delivery Pressure Monitor*

The Delivery Pressure Alarm function will monitor pressure signals from Delivery Pressure meter. Pressure signals beyond alarm limits will cause alarms to be generated.

Separate high and low alarms shall be provided for each single and parallel pump combinations.

The alarm limits used are:

i)	With one Pump running alone:	One Pump – High Pressure Limit, and One Pump – Low Pressure Limit
ii)	With two Pumps running:	Two Pumps – High Pressure Limit, and Two Pumps – Low Pressure Limit

The alarming for pressure shall be inhibited when there are no pumps running to avoid nuisance alarms.

When any one pump begins to run or stop, the pressure Inhibit Alarm Timer (set to 10 secs) for the pressure meter shall begin timing. The alarming for the pressure meter shall be temporarily inhibited until after the time expires.

~~1.1.17~~4.1.17 *Pump Availability*

Refer to Section 3.2.

~~1.1.18~~4.1.18 *Pump Running*

The Pump Running function will determine whether a particular pump is running or stopped by monitoring the Pump Variable Speed Drive "VSD Running" digital input.

~~1.1.19~~4.1.19 Pump Number of Starts

The Pump Number of Starts function will monitor and calculate the number of pump starts that have occurred since reset.

A pump, when selected in remote, is only permitted 12 starts within any 1 hour period. To ensure this limit is not exceeded, the pump will not be permitted to start again for five (5) minutes after the pump completes a full start-up sequence. This will ensure that only a maximum of 12 pump starts can occur for each pump every hour.

In the event of a surcharge, or the pump station being selected is in Local Mode, this lockout will be disabled allowing the pump to start.

~~1.1.20~~4.1.20 Pump Hours Run

The Pump Hours Run function will monitor the number of hours that a pump has been running~~is run by a pump.~~

~~1.1.21~~4.1.21 Pump Reflux Valve Failure

Refer to Section 3.2.9.

~~1.1.22~~4.1.22 Pump Variable Speed Drive Not Ready

Refer to Section 3.2.5.

~~1.1.23~~4.1.23 Pump Variable Speed Drive Warning

Refer to Section 3.2.5.

~~1.1.24~~4.1.24 Pump Emergency Stop

Refer to Section 3.2.8.

~~1.1.25~~4.1.25 Plant Availability Index for Pumps

A progressive monthly plant availability index shall be calculated for each group of functionally related plant. An item of plant is said to be "available" whenever normal operation is possible, ie. when the following conditions are true:

i) The equipment is available for normal operation (ie. not local, power available and no tripped faults).
ii) The equipment is not locked out and a request to operate has been made.

For each item of plant, including sewage pumps, and remote controlled valves, the times and dates for changes in the "plant availability" shall be recorded for use in the calculation of a plant availability index.

NOTE: The time and date of changes in the "plant availability" will be stored in an analogue history buffer at the master station. A process called "histproc" will handle this functionality.

At any instant, percentage availability "A" shall be given by:

$$A = (\text{Capacity Available} / \text{Capacity Installed}) \times 100$$

The plant availability index shall be the progressive mean of "A" above, reset at the beginning of every month.

A low priority "station outage" alarm shall be produced and used to initiate reports when the plant availability for the group of functionally related plant falls below an operator adjustable minimum percentage.

The intention is that the alarm should indicate when insufficient plant is available for normal design operation. For example, in a site with three pumps where one is normally for standby, the alarm shall be initiated when the plant availability is less than 2/3.

~~1.1.26~~4.1.26 Plant Utilisation Index for Pumps

A progressive monthly plant utilisation index shall be calculated for each group of functionally related plant. An item of plant is said to be "utilised" when it is operating normally, ie. pump is on-line or running.

At any instant, the percentage utilisation "U" shall be given by:

U = (Capacity Operating / Capacity Installed) x 100

The plant utilisation index shall be the progressive mean of "U" above, reset at the beginning of every month.

~~1.1.27~~4.1.27 Hydraulic Power Consumption

The Hydraulic Power Consumption will be used to calculate Motor Efficiency as explained in Section 4.1.31.

Daily hydraulic power consumption shall be calculated for each single pump from the product of pressure and flow as follows:

Ph = K * Fe * M * dT

Where:

Ph	-	the hydraulic power consumption (kWHr)
Fe	-	the pump delivery flow rate (l/sec) derived (see "Flow Estimation" below)
M	-	the differential pressure generated by the pump (see "Differential Pressure" below)
K	-	an estimated constant derived from the pump test characteristics relating the product of F * P to power (kW)
dT	-	the number of hours in the integration period (24 hours)

In order to calculate the hydraulic energy supplied by a pump, it is necessary to measure the differential pressure (M) and the estimated generated flow (Fe).

Flow Estimation, Fe

When one pump is operating, the flow used in the efficiency calculation shall be the measured flow from the flow meter signal.

When two pumps operate in parallel, they shall operate at the same speed and the flow for each pump shall be assumed to be half of the total flow.

Differential Pressure, M

The differential pressure can be calculated using pump delivery pressures less pump suction pressure:

M = Delivery Pressure - Wet Well Level (MAHD)

Where:
M is the differential pressure generated by the pump

The calculations shall not be carried out when a pump is not operating, ie the last calculated value shall be retained as the current value.

It shall be possible for the operator to readily adjust calculations and constants. Adjustments would, for example, be required when a pump is replaced or overhauled.

~~1.1.28~~4.1.28 Electrical Power Consumption

The Electrical Power Consumption calculation will work out the electrical power consumption of each pump. Power consumption shall be calculated using the motor kW readings and by integration over the operating time.

$$Pe = P * dT$$

Where:

Pe	-	the electrical power consumption (kWHr)
P	-	power (kW) reading
dT	-	the number of hours in the integration period.

Daily electrical power consumed for each single pump shall be calculated.

The calculations shall not be carried out when a pump is not operating, ie the last calculated value shall be retained as the current value.

It shall be possible for the operator to readily adjust calculations and constants. Adjustments would, for example, be required when a pump is replaced or overhauled.

~~1.1.29~~4.1.29 Motor Current Monitor

The Motor Current sequence will monitor the motor current signal and generate appropriate alarms. High and low alarms shall be provided for each motor current monitored.

Alarms shall be inhibited when the pump is off. Alarms shall also be inhibited for a given period of time after the pump starts running.

Each pump will have an individual PLC adjustable time delay period initially set to 30 seconds.

~~1.1.30~~4.1.30 Motor Power Monitor

The Motor Power function will monitor the motor power (kW) signal, perform signal filtering, and generate appropriate high and low alarms for each pump.

Each single and parallel pump combination shall have separate upper and lower alarm limits. The alarming for a given pump, shall be inhibited when the pump stops running. The high and low alarm flags shall not cause any control action to be initiated, eg stopping a pump already running.

When another pump starts to run, the Pump Power Inhibit Alarm Timer (set to 30 secs) for the operating pump shall begin timing. The alarming for each pump shall be temporarily inhibited until after the timer times out.

~~1.1.31~~4.1.31 Motor Efficiency

The motor efficiency will be calculated as the ratio between the hydraulic power consumption, Ph, over the electrical power consumption, Pe, measured over the same period of time:

$$Ee = \frac{Ph}{Pe} x\, 100$$

Where:

Ee	-	percentage motor efficiency

Pe	-	electrical power consumption
Ph	-	hydraulic power consumption

Separate efficiency calculations shall be carried out for each pump.

~~1.1.32~~4.1.32 Pump Not in Auto Mode

Refer to Section 3.2.5.

~~1.1.33~~4.1.33 Pump Running Speed

Each pump VSD will provide a 4-20 mA analog input to the PLC to indicate the pump running speed. The PLC will monitor this signal.

~~1.1.34~~4.1.34 Pump Speed Control

When the pumping station is in Remote mode, the pump speed will be controlled by the PLC as explained in Section 2.4. When the pumping station is in local mode, the pump speed will be controlled from the speed potentiometer.

~~1.1.35~~4.1.35 Well Washer Control

Refer to Section 2.4.4.

~~1.1.36~~4.1.36 Pump Blockage Alarm

In order to detect possible blockage of the pump impellers, a "Pump Blockage" alarm shall be raised by the PLC. This shall occur after a PLC adjustable time period if the pump speed is 50Hz and the pump flow is less than 60 l/sec. This shall be a priority one alarm.

~~1.1.37~~4.1.37 Pump Station Electrical Surge Protection Alarm

If the surge diverters on the incoming supply fall to 60% capacity due to their operation in diversion of surge voltages, an alarm shall be initiated. This signifies that the surge diverters should be replaced at the next maintenance opportunity.

~~1.2~~4.2 RTU and PLC Controls and Sequences

Initially after power up or after downloading new code, the RTU shall perform the following control:

- Set the communication destination to Cullen Avenue

The PLC shall perform the following control:

- Set Pump 1 as Duty 1 pump.
- Reset the duty lock flag.
- Set the first initialise flag after downloading only.
- Set the PLC start flag. This flag will be reset after the first scan.
- Set the first power up flag after restoration of power only.
- Reset the battery fault flag.

The following is a summary of the controls and sequences performed in the PLC:

a) Cathodic Protection Test Sequence
b) Wet Well Level Instrument Calibration Check
c) Pump Duty Selection
d) Pump Station Control
e) Pump Individual Control
f) Pump Status Indication Lamp

Presented below is a brief description of each item and its functionality.

~~1.1.14~~.2.1 *Cathodic Protection Test Sequence*

The Cathodic Protection Test Sequence will control the cathodic protection equipment and monitor its performance. The following PLC configuration shall be provided to allow for interfacing to the existing Cathodic Protection equipment.

The monitoring and control sequence shall be as follows:

a) The digital input "CP power available" shall be continuously monitored and, upon change of state, logged and alarmed.

b) The rectifier voltage and current shall be continuously monitored and alarmed and logged if the values are above or below alarm limits. These alarm limits shall be readily adjustable by the operator from the control page. Upon the above alarm being initiated, the rectifier unit shall be de-energised via the digital output "De-energise CP rectifier unit", until the local or remote reset is activated.

c) At predetermined times, selectable by the operator from a control set-up page at Cullen Avenue, a test sequence shall be initiated. It shall also be possible to initiate a sequence at any time by "manual" selection. It is likely that the sequence will be initiated no less frequently than once a month or more frequently than once every 12 hours, ie

12 hours <= time between test sequences <= 1 month.

d) When the test sequence is initiated, the digital output "connect CP reference electrodes" shall be energised. After this relay is energised, the reference electrode "on potential" voltages shall be monitored, logged and alarmed if the values are above or below alarm limits. These alarms shall be readily adjustable by the operator from the control page.

e) Upon completion of the above and after a time delay of one second, the digital output "De-energise CP rectifier unit" shall operate, causing the reference voltage to decay. After a SCADA adjustable time of between 0.1 and 60 seconds, the analog "off potential" shall be monitored, logged and alarmed if the values are above or below limits. These alarm limits shall be readily adjustable by the operator from the control page.

f) After the completion of the above, the relay "Connect CP reference electrodes" and relay "De-energise CP rectifier unit" shall de-energise and the sequence returns to the start.

~~1.1.24~~.2.2 *Wet Well Level Instrument Calibration Check*

The controls shall include a Wet Well "Calibration Check" sequence. This sequence is used to check the validity of the level probe reading.

The sequence shall either be initiated remote manually (by an operator) or automatically (on a monthly basis at predetermined times and dates). The automatic start of the calibration shall still require operator confirmation before starting; this is to cater for wet weather conditions.

It shall be possible for the operator to readily inhibit automatic and manual operation.

Once a calibration check is initiated, the following shall occur:

i) The sequence shall begin by stopping all operating pumps.
ii) Normal controls and related level alarms shall be inhibited.
iii) The level in the wet well will increase until the "surcharge imminent" electrode is reached. The level of the wet well shall be recorded at this point and compared with the known level of the

"surcharge imminent" electrode. An alarm shall be generated if the level is not within 25 mm of the surcharge electrode level.

iv) The pumps shall start.

v) A short PLC adjustable time delay shall be allowed for the level to fall during which time normal level alarms shall remain inhibited.

vi) Control and associated alarms shall return to normal.

During the calibration the following actions can take place:

i) The operator can inhibit/stop the calibration sequence.

ii) If a site worker switches the pumps to local mode while the calibration sequence is in progress, the sequence is suspended.

iii) The operator is notified of the suspension. Once the pumps have returned to remote mode the calibration shall restart from the beginning of the sequence, only after acknowledgment from the operator.

iv) If the duration of a calibration sequence exceeds 1 hour the operator shall be notified.

~~1.1.3~~4.2.3 Pump Duty Selection

See Section 2.3.

~~1.1.4~~4.2.4 Pump Station Control

See Section 2.2.

~~1.1.5~~4.2.5 Pump Individual Control

See Section 3.2.

~~1.1.6~~4.2.6 Pump Status Indication Lamp

The Pump Status Indication Lamp PLC output will remain steady on if the pump has completed its start up sequence and the pump VSD running input is active. The lamp will remain active until this signal becomes inactive.

The pump status indication lamp will flash slow (1 sec on / 1 sec off) if the pump is unavailable for PLC control. The lamp will cease to flash slow when the pump becomes available for PLC control.

The pump status indication lamp will flash fast (0.2 sec on / 0.3 sec off) if the pump is locked out due to the lock out timer not expired. The lamp will cease to flash fast when the lockout timer expires.

~~1.3~~4.3 Summary of PLC Generated Alarms

The following alarms will be generated by the PLC and sent to Cullen Avenue. Most of these alarms are point attributes that are set and reset using handlers in the PLC. Some, however, are actual digital inputs (DIT) and pseudo digital inputs (DIP) allocated a channel in the PLC.

Code	Alarm Description	Type
stnXmainsFail	Power Fail Alarm	DIP
stnXsrgprotFail	Pump Station Electrical Surge Protection Alarm	DIP
rtuXmainsFail	RTU Power Fail Alarm	DIP
rtuXbatteryAlarm	RTU Battery Alarm	DIP
wwlXlevelInvalid	Wet Well Level Invalid	DIP
wwlxhighAlarm	Wet Well High Level	DIP
wwlXlowAlarm	Wet Well Low Level	DIP
wwlXsurchPrbAlm	Surcharge Probable Alarm	DIP

Code	Alarm Description	Type
wwlXsurchImmAlm	Wet Well Surcharge Imminent Alarm	DIP
wwlXsurchOccAlm	Surcharge Occurring Alarm	DIP
flwXinvalid	Flow R~~r~~ate ~~i~~Invalid	DIP
flowXlowAlarm	Flow ~~r~~Rate Low Alarm Flag	DIP
flwXhighAlarm	Flow ~~r~~Rate High Alarm Flag	DIP
flwXvolInvalid	Volume Invalid Flag	DIP
preXinvalid	Pressure Invalid F~~f~~lag	DIP
preXalarmInhibit	Pressure Alarming Inhibited	DIP
preXlowAlarm	Pressure Low Alarm Flag	DIP
preXhighAlarm	Pressure High Alarm Flag	DIP
pmpXrflxOpenFlt	Reflux Valve Fail to Open Flag	DIP
pmpXrflxOpenRst	~~Reflux~~ Reflux Valve Fail To Open Fault Auto Reset Flag	DIP
pmpXrflxCloseFlt	Reflux Valve Closing Fault Flag	DIP
pmpXrflxOpenExcd	Reflux Valve Fault Count Exceeded Flag	DIP
pmpXVSDWarn	VF Drive Warning Flag	DIP
pmpXVSDFault	VF Drive Not Ready Flag	DIP
pmpXVSDExcd	VF Drive Fault Count Exceeded Flag	DIP
pmpXVSDAuto	VF Drive in Auto Mode Flag	DIP
pmpXVSDReset	VF Drive Trip Auto Reset Flag	DIP
pmpXemergencyStp	Emergency Stop Pushbutton Fault Flag	DIP
pmpXlockout	Lockout Flag	DIP
pmpXpmpWellFlood	Pump Well Flooded Fault Flag	DIP
stnXoutage	Pump Station outage alarm	DIP
pmpXcurrLoAlarm	Current Low Alarm Flag	DIP
pmpXcurrHiAlarm	Current High Alarm Flag	DIP
pmpXmotorPwrLoAl	Power Low Alarm Flag	DIP
pmpXmotorPwrHiAl	Power High Alarm Flag	DIP
cprXrectVoltLoAl	Rectifier Voltage Low Alarm	DIP
cprXrectVoltHiAl	Rectifier Voltage High Alarm	DIP
cprXrectCrntLoAl	Rectifier Current Low Alarm	DIP
cprXrectCrntHiAl	Rectifier Current High Alarm	DIP
cprXonPtnlLoAl	Refr Electrode On Potential Lo Alarm	DIP
cprXonPtnlHiAl	Refr Electrode On Potential Hi Alarm	DIP
cprXofPtnlLoAl	Refr Electrode Off Potential Lo Alarm	DIP
cprXofPtnlHiAl	Refr Electrode Off Potential Hi Alarm	DIP
wwlXcaliFault	Calibration Error Alarm Flag	DIP
wwlXcaliStrtReq	Operator Initiate Calibration Check Request	DIP
wwlXcaliFailed	Calibration Sequence Failed Flag	DIP
wwlXcaliAborted	Calibration Aborted Flag	DIP
wwlcaliLocAbort	Calibration suspended due to Local Mode switch	DIP
wwlXcaliRemResum	Resume Calibration Check after Suspend Rqst	DIP

Code	Alarm Description	Type
stnXoperate	Duty Pump Required to Operate	DIP
pmpXfault	Pump Failure Status	DIP
ssXskipped	Slime Stripping Skipped Due to Wet Weather Event	DIP
ssXAborted	Slime Stripping Aborted	DIP
cprXpwrFlt	CP Power Available	DIP
pmpxblk	Pump Blockage Alarm	DIP
	Well Washing Flow Low	DIP
	Well Washing Solenoid Valve Failed to Close	DIP
	Pump x Motor Current High	DIP
	Pump x Motor Current Low	DIP
	Pump x Motor Power High	DIP
	Pump x Motor Power Low	DIP
	Generator Fault	DIP
	Generator Failed	DIP
	Generator Fuel Low	DIP

5. I/O Listing

The following I/O List is the proposed minimum I/O associated with the Heroes Avenue Pumping Station PLC.
The final list will be developed by the contractor to reflect the details of the equipment supplied.
At the completion of commissioning there shall be 10% spare I/O of each type.

Digital Input Card No 1 – Rack 1 Slot 3

Address		Mnemonic Description	LED Off	LED On
DI1	P1Pwr	Pump No 1 Power On	Off	On
DI2	P1SrPB	Pump No 1 Start Pushbutton	Not pressed	Pressed
DI3	P1LSpPB	Pump No 1 Stop Pushbutton	Not pressed	Pressed
DI4	P1LRst	Pump No 1 Local Reset Pushbutton	Not pressed	Pressed
DI5	P1SpPB	Pump No 1 MCC Emergency Stop Pushbutton	Pressed	Not pressed
DI6	P1	Pump No 1 Bearing Thermistor Trip	Not Tripped	Tripped
DI7	P1	Pump No 1 Stator Housing Water Detected	Water	No Water
DI8	P1VSDW	Pump No 1 VSD Warning	No Warning	Warning
DI9	P1VSDRD	Pump No 1 VSD Ready	Not ready	Ready
DI10	P1VSDA	Pump No 1 VSD Auto Selected	Not in Auto	Auto
DI11	P1VSDR	Pump No 1 VSD Running	Not running	Running
DI12	P1	Pump No 1 Thermistor Trip	Not Tripped	Tripped
DI13	P1Rflx	Pump No 1 Reflux Valve Micro Switch	Valve Open	Valve Closed
DI14		Pump No 1 Isolating Contactor Closed	Open	Closed
DI15		Pump No 1 Field Emergency Stop Pushbutton	Pressed	Not Pressed
DI16				

Digital Input Card No 2 – Rack 1 Slot 4

Address		Mnemonic Description	LED Off	LED On
DI17	P2Pwr	Pump No 2 Power On	Off	On
DI18	P2SrPB	Pump No 2 Start Pushbutton	Not pressed	Pressed
DI19	P2LSpPB	Pump No 2 Stop Pushbutton	Not pressed	Pressed
DI20	P2LRst	Pump No 2 Local Reset Pushbutton	Not pressed	Pressed
DI21	P2SpPB	Pump No 2 MCC Emergency Stop Pushbutton	Pressed	Not pressed
DI22	P2	Pump No 2 Bearing Thermistor Trip	Not Tripped	Tripped
DI23	P2	Pump No 2 Stator Housing Water Detected	Water	No Water
DI24	P2VSDW	Pump No 2 VSD Warning	No Warning	Warning
DI25	P2VSDRD	Pump No 2 VSD Ready	Not ready	Ready
DI26	P2VSDA	Pump No 2 VSD Auto Selected	Not in Auto	Auto
DI27	P2VSDR	Pump No 2 VSD Running	Not running	Running
DI28	P2	Pump No 2 Thermistor Trip	Not Tripped	Tripped
DI29	P2Rflx	Pump No 2 Reflux Valve Micro Switch	Valve Open	Valve Closed
DI30		Pump No 2 Isolating Contactor Closed	Open	Closed
DI31		Pump No 2 Field Emergency Stop Pushbutton	Pressed	Not Pressed
DI32				

Digital Input Card No 3 – Rack 1 Slot 5

Address		Mnemonic Description	LED Off	LED On
DI33	P3Pwr	Pump No 3 Power On	Off	On
DI34	P3SrPB	Pump No 3 Start Pushbutton	Not pressed	Pressed
DI35	P3LSpPB	Pump No 3 Stop Pushbutton	Not pressed	Pressed
DI36	P3LRst	Pump No 3 Local Reset Pushbutton	Not pressed	Pressed
DI37	P3SpPB	Pump No 3 MCC Emergency Stop Pushbutton	Pressed	Not pressed
DI38	P3	Pump No 3 Bearing Thermistor Trip	Not Tripped	Tripped
DI39	P3	Pump No 3 Stator Housing Water Detected	Water	No Water
DI40	P3VSDW	Pump No 3 VSD Warning	No Warning	Warning
DI41	P3VSDRD	Pump No 3 VSD Ready	Not ready	Ready
DI42	P3VSDA	Pump No 3 VSD Auto Selected	Not in Auto	Auto
DI43	P3VSDR	Pump No 3 VSD Running	Not running	Running
DI44	P3	Pump No 3 Thermistor Trip	Not Tripped	Tripped
DI45	P3Rflx	Pump No 3 Reflux Valve Micro Switch	Valve Open	Valve Closed
DI46		Pump No 3 Isolating Contactor Closed	Open	Closed
DI47		Pump No 3 Field Emergency Stop Pushbutton	Pressed	Not Pressed
DI48				

Digital Input Card No 4 – Rack 1 Slot 6

Address		Mnemonic Description	LED Off	LED On
DI49	PRst	Pump Station Site Attention Alarm Reset	Not Reset	Reset
DI50	PstPWR	Pump Station Site Power On	Not on	On
DI51	PstLR	Pump Station Selector Local/Remote	Local	Remote
DI52	PstSrg	Pump Station Surcharge Imminent Level Switch	High	Not High
DI53		Spare		
DI54	PstInt	Pump Station Cubicle Door Open	Closed	Open
DI55	PstFlt	Pump Station Flow Meter Fault	Fault	No Fault
DI56	PstPls	Pump Station Flow Meter Pulse	No Pulse	Pulse
DI57		Well Washing Flow Switch	No Flow	Flow
DI58		Pump Station Dry Well Flooded	Flooded	Not Flooded
DI59		Pump Station Electrical Surge Protection	Healthy	Not Healthy
DI60		Spare		
DI61		Spare		
DI62		Cathodic Protection Alarm Reset		
DI63		Cathodic Protection Power Available		
DI64		Spare		

Digital Input Card No 5 – Rack 1 Slot 7

Address		Mnemonic Description	LED Off	LED On
DI65		Generator Fault		
DI66		Generator Failed		
DI67		Generator Fuel Low		
DI68		Generator Running		
DI69		Generator Connected		
DI70		Spare		
DI71		Spare		
DI72		Spare		
DI73		Spare		
DI74		Spare		
DI75		Spare		
DI76		Spare		
DI77		Spare		
DI78		Spare		
DI79		Spare		
DI80		Spare		

Digital Output Card No 1 – Rack 1 Slot ~~8~~7

Address		Mnemonic Description	LED Off	LED On
DO1	P1Sts	Pump No 1 Status	Not running	Running
DO2	P1FRST	Pump No 1 Fault Reset	Not reset	Reset
DO3		Spare		
DO4	P1VSDRn	Pump No 1 VSD Run	Stop	Run
DO5	P2Sts	Pump No 2 Status	Not running	Running
DO6	P2FRST	Pump No 2 Fault Reset	Not reset	Reset
DO7		Spare		
DO8	P2VSDRn	Pump No 2 VSD Run	Stop	Run

Digital Output Card No 2 – Rack 1 Slot 98

Address		Mnemonic Description	LED Off	LED On
DO9	P3Sts	Pump No 3 Status	Not running	Running
DO10	P3FRST	Pump No 3 Fault Reset	Not reset	Reset
DO11		Spare		
DO12	P3VSDRn	Pump No 3 VSD Run	Stop	Run
DO13		Well Washing Solenoid Valve Open	Close	Open
DO14	RecD	De-energise rectifier unit	Off	On
DO15	Refelc	Connect Reference electrode	Off	On
DO16	CPAlrm	Cathodic protection alarm	No Alarm	Alarm

Digital Output Card No 3 – Rack 1 Slot 109

Address		Mnemonic Description	LED Off	LED On
DO17		Site Attention Alarm	No Alarm	Alarm
DO18		Generator Remote Start Indication~~Spare~~		
DO19		Generator Remote Stop Indication~~Spare~~		
DO20		Spare		
DO21		Spare		
DO22		Spare		
DO23		Spare		
DO24		Spare		

Analog Input Card No 1 – Rack 2~~1~~ Slot 1~~0~~

Address		Mnemonic Description	4 – 20mA Engineering Units
AI1	P1kW	Pump No 1 Power	0 – 150 kW
AI2	P1Amps	Pump No 1 Current	0 – 300 Amps
AI3	P1VSDsp	Pump No 1 VSD Speed	0 – 50 Hz
AI4		Spare	
AI5	WTWLV	Wet well level	-4.5 m – 3.5 m
AI6	DlvPrss	Delivery pressure	0 – 500 kPa
AI7	DlvFlow	Delivery Flow	0 – 600 l/sec
AI8		Spare	
AI9	P2kW	Pump No 2 Power	0 – 150 kW
AI10	P2Amps	Pump No 2 Current	0 – 300 Amps
AI11	P2VSDsp	Pump No 2 VSD Speed	0 – 50 Hz
AI12		Spare	
AI13	RectI	Rectifier Current	
AI14	RectV	Rectifier Voltage	
AI15	Refel1	Reference Electrode No 1	
AI16	Refel2	Reference Electrode No 2	

Analog Input Card No 2 – Rack 2 Slot 2~~1~~

Address		Mnemonic Description	4 – 20mA Engineering Units
AI17	P3kW	Pump No 3 Power	0 – 150 kW
AI18	P3Amps	Pump No 3 Current	0 – 300 Amps
AI19	P3VSDsp	Pump No 3 VSD Speed	0 – 50 Hz
AI20		Spare	
AI21		Spare	
AI22		Spare	
AI23		Spare	
AI24		Spare	
AI25		Spare	
AI26		Spare	
AI27		Spare	
AI28		Spare	
AI29		Spare	
AI30		Spare	
AI31		Spare	
AI32		Spare	

Analog Output Card No 1 – Rack 2 Slot 32

Address		Mnemonic Description	4 – 20mA Engineering Units
AO1	P1SPC	Pump No 1 Speed Command	0 – 100%
AO2	P2SPC	Pump No 2 Speed Command	0 – 100%
AO3	P3SPC	Pump No 3 Speed Command	0 – 100%
AO4		Spare	

Attachment 1 - Drawing Schedule

Drawing No.	Title
486/5/7-LI010	Heroes Avenue Pump Station Power and Metering Schematic Sheet 1
486/5/7-LI011	Heroes Avenue Pump Station Power and Metering Schematic Sheet 2
486/5/7-LI012	Heroes Avenue Pump Station RTU Cabinet Schematic Diagram Sheet 1
486/5/7-LI013	Heroes Avenue Pump Station RTU Cabinet Schematic Diagram Sheet 2
486/5/7-LI014	Heroes Avenue Pump Station RTU Cabinet Schematic Diagram Sheet 3
486/5/7-LI015	Heroes Avenue Pump Station Pump No 1 Schematic
486/5/7-LI016	Heroes Avenue Pump Station Pump No 2 Schematic
486/5/7-LI017	Heroes Avenue Pump Station Pump No 3 Schematic
486/5/7-LI018	Heroes Avenue Switchboard General Arrangement