Brisbane Water

OPERATION AND MAINTENANCE MANUAL

FOR

HAY STREET, MITCHELTON

CHLORAMINATION FACILITY

First Issue - ***Copy 4***

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Operation & Maintenance Manual - Hay Street Chlorination Facility

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1 INTRODUCTION

1.1 Overview

The water distribution system in the Grovely and Mitchelton zones has been identified as being at risk from growth of nitrifying bacteria particularly during the summer months when chloramine levels have been found to decrease below the recommended minimum (1.5 mpl) level. To safeguard water quality, local dosing of chloramine is carried out from a facility installed at the Hay Street, Mitchelton pump station.

Equipment consists of two 1,500 litre storage tanks containing sodium hypochlorite and ammonium sulphate (10% w/v) solution and fitted with diaphragm dosing pumps. (*Refer to Table 1& Table 2 which indicates the storage tank, pump and associated plumbing for each chemical system.*) The sulphate is dosed into the DN600 potable trunk main inlet to the pump station while the hypo-injection point is on the DN410 main outlet from the pump station. Both dosing rates are in proportion to the metered water main flow.

The equipment is housed in a transportable brick building located adjacent to the Hay Street pump station and monitored from the Newstead control centre.

1.2 Chloramination Control System

The Hay St. Chloramination facility will be controlled by the existing MITS RTU (Remote Terminal Unit) which will interface with the telemetry system connected to the Central Control Room at Newstead.

Currently, the telemetry unit RTU is located at the site and the RTU will be connected to this RTU via a communication cable to exchange in formation and to receive control commands from the Newstead Central Control Room.

The Hay Street Pump Station incorporates two main water pumps. With the first pump running, the station output is 260 L/sec nominal (i.e. 8.4 ML/day) and with two pumps operating, the station output is 390 L/sec nominal (i.e. 12.6 ML/day). The Chloramination facility has been sized to chloraminate 12.6 ML/day of water on a daily basis.

Each of the chemicals will be dosed with a diaphragm pump. The two (2) Chloramine Dosing Pumps will be driven by 0.37 kW motors, each speed controlled by means of a Variable Frequency Drive. Dosing rates are adjusted either by varying:

- the pump speed via variable frequency drive or;
- the stroke on the pump.

Typical conditions for Chloramination are as follows:

	Periods of One Pump operating	**Periods of Two Pumps operating**
Pumped Water:	260 L/sec. (nominal)	390 L/sec. (nominal)
Sodium Hypochlorite dosing rate:	17.9 L/hr	26.9 L/hr
Ammonium Sulphate dosing rate:	14 L/hr	21 L/hr

2 DESCRIPTION OF EQUIPMENT

2.1 Chloramination Building

The Chloramination dosing equipment is housed in a transportable brick building supplied by Barrier Engineering and Construction. The building is 6.1 x 3.3 x 2.7 m in size with a colorbond skillion roof. Construction is single skin reinforced brick on a concrete slab base and internal brick walls divide the room into three areas. The three areas include a general operating area and two bunded areas for the tanks and dosing pumps. The two bund areas are sized to carry in excess of 110% of the chemical tank volume.

The internal floor and walls are coated with a two-pack Epirez epoxy system while the external walls have Epirez epoxy moisture block and anti-graffiti coatings. Ventilation is provided by fixed louvres set into the door and two roof mounted fans. The building is also equipped with lighting, 240V power outlets and a safety shower/eye wash unit and has a floor waste in the operating area piped externally to the driveway and reclaim sump.

2.2 Chemical Storage Tanks

The tanks were supplied by Nylex Notomould and are of a high density polyethylene material with a potential capacity of 1,500 litres. Due to present plumbing configuration concerning the sight gauges, vent and drain connection, the present capacity of each tank is 1,100 litres. Each tank is fitted with a filling point, drain, overflow, vent, level sensor and an outlet feeding the dosing pump. Each tank and dosing system is contained within its own bunded area able to hold the full tank contents should a major leak occur. The bunded areas have a sump for ease of liquid recovery but no external drainage connection.

The two chemicals to be always used for the Chloramination process are sodium hypochlorite (hypo) and ammonium sulphate solution, each with a concentrate value of 10%.

2.3 Chemical Dosing Pumps

The two Chemical Dosing pumps are Alldos KM251 piston diaphragm dosing pumps and have:

- capability for dosing rates of 2 to 24L/hr at pressures up to 1000KPa;
- a 15:1 turndown under variable speed control;
- a reciprocating displacement diaphragms with the hydraulic diaphragm actuated from an variable speed driven electric motor;
- an effective stroke length which can be adjusted continuously and linearly from 10 to 100% by a stroke adjustment knob with a vernier scale;
- a PVC head, PTFE Diaphragm, glass V balls and viton *(for sodium hypochlorite)* and hypalon *(for ammonium sulphate)* gaskets and V seats respectively.
- an internal overpressure relief valve which is fully adjustable and bypasses hydraulic oil internally in the event of a closed or blocked discharge valve;
- a dosing flow accuracy of less than 1% throughout the pump range;
- a moulded polyethylene mounting base;
- an 0.37 KW, three phase 220-240V, 50Hz, IP65 motor with insulation class F.

Refer to Appendix 7 for technical details of the operation and maintenance of the Pumps and associated equipment, ie injection quills, solenoid valves, position indicators, pressure retention valves, plastic flow meters and switches

2.4 Electrical and Telemetry Equipment

Details of the telemetry and electrical equipment are identified in Appendices 1,2 & 9.

2.5 Dosing Rates

Both of the chemicals dosing rate will be determined by the potable water out flow rate from the pump station:

- Under automatic control: the water outlet flow rates will be measured by an existing flowmeter installed in the DN 410 potable trunk water main supplying the suburban reticulation, and the Hypo and Ammonium Sulphate dosing rates will be adjusted by changing the dosing pumps speed via the RTU.

- Under manual control: the dosing rate may be set by the Operator on site either by adjusting the pump stroke or via pump speed potentiometer mounted on the pumps starter pane.

2.6 Services Conduits

Cables enter and exit the building via DN100 PVC conduits set into the floor and running underground to terminal points inside the pump station. Similar conduits carry a DN15 Cu mains water supply and DN15 PVC chemical dosing (flexible hose) lines which run separately from each pump to the respective injection point on the water main.

2.7 Vehicle Access

Chemical deliveries are made by road tanker. An all-weather driveway is provided off Hay Street extending to a concrete parking bay beside the chloramination building. This area slopes to the North-East corner where a sump captures any spillage (up to approx 1,500 litres) for recovery.

The sump is fitted with a manually operated DN100 gate valve which must be closed during chemical transfer operations but otherwise left open to drain away storm water.

3 DESIGN CRITERIA AND PROCESS DESCRIPTION

3.1 Building Design

Refer to: Barrier Engineering - Dwgs 17357-01 to 16, Rev A; Bill Gamble Project Consultants - Computations Sheet No. 17357, p.1-10; Brisbane Water Building Site and Locality Plans - Dwgs 486/4/7 - JQ011 to JQ013.

The building layout was designed such that the installation would comply with AS3790-1994 - The Storage and Handling of Corrosive Substances. The internal floor and walls and external walls are coated with Epirez epoxy products. Refer to Barrier Engineering Dwg No. 17357-07, -13, -14, -15, -16 & -17. The "as constructed drawings reflect that the Epirez epoxy paint was applied to the whole wall from floor to ceiling.

3.2 Storage Tanks and Dosing Lines

The Storage Tanks and Dosing Lines control system has the following features:

- monitoring of the chemical free surface level in the storage tanks with set points for: tank level low-low, level low, level rate of drop and level high alarms;
- electrically actuated valves on he tank outlet will provide facility to isolate the tank in case of a pipe burst detected by the rate of tank level drop;
- setting of the speed of the Dosing Pumps via their Variable Frequency Drives dependant on the dosing rate either via manual potentiometer or via the RTU selected two fixed speed signals;
- monitoring of the pump discharge pressure via a pressure transmitter mounted next to each injection quill;
- monitoring of the bund level via level switches mounted in each bund;
- local and remote indication of the Pump station outlet flow rate;
- periodic manual flushing of the dosing lines with potable water to reduce the build-up of settled particles;
- Hypo and Ammonium Sulphate dosing rates control will be flow paced affected by means of an open lop controller, such that the existing flowmeter on the DN.410 potable trunk water main will provide the pump station outlet flow rate as follows:

  Status 1: no main pump is running therefore the flow rate is 0, shut down the dosing pumps;

  Status 2: one main pump is running, the flow ranges between 250 L/sec. to 320 L/sec. (depending on the discharge head), for this range the RTU will select the first speed settings for the pumps to dose the calculated dosing rate of 17.9 L/hr of Hypo and 14 L/hr of Ammonium Sulphate;

  Status 3: two pumps are running, the flow ranges between 320 L/sec. to 450 L/sec. (depending on the discharge head), for this range the RTU will select the second speed setting for the dosing pumps to dose the calculated rate of 26.9 L/hr of Hypo and 21 L/hr of Ammonium Sulphate;

3.3 Dosing Operations and Control

Refer to Brisbane Water Dwg 486/4/7 - JQ002

3.4 Chemical Deliveries

The 10% solutions of ammonium sulphate and sodium hypochlorite are delivered under contract by Elite Chemicals on an as required basis. Deliveries are initiated by Water Utility personnel who are able to continuously monitor the storage tank contents at the Hay Street facility. When a tank low level alarm signal is received at Newstead, indicating a stock level equivalent to 24 hours usage, the duty operator will alert Elite chemicals or the approved supplier and order a refill of the particular solution. Checklist procedure for Refilling is attached in Appendix 3.

5 START UP AND SHUT DOWN PROCEDURE

5.1 Dosing System Start Sequence 'Remote'

Upon receival of a dosing system start command from Newstead or by pressing the 'remote test start' push-button on the starter panel, providing the system is available for remote control, the RTU will take following actions:

- Open Hypo Storage Tank outlet actuated valve;
- Confirm that the valve is fully open then start Hypo Dosing Pump;
- Wait for 30 seconds and check the pump discharge pressure signal, if it is above the low limit then continue operation and if it remains in low limit then stop the pump, close the outlet valve and generate dosing Line Pressure Low alarm;
- Open Ammonium Sulphate Storage Tank outlet actuated valve;
- Start Ammonium Dosing Pump;
- Wait for 30 seconds and check the pump discharge pressure signal, if it is above the low limit then continue operation and if it remains in low limit then stop both of the pumps, close the outlet valves and generate an alarm;
- The RTU will signal 'Dosing System Operating' to the Telemetry system and the dosing pumps running lights on the Control Centre will be on.

5.2 Dosing System Stop Sequence 'Remote'

Upon receival of a dosing system stop command from Newstead or by pressing the 'remote test stop; push-button on the starter panel, providing the system is operating in remote control, the RTU will take following actions:

- Stop both of the dosing pumps;
- Close both of the storage tanks outlet actuated valves;
- The RTU will signal 'Dosing System Stopped' to the Telemetry system and the dosing pumps running lights on the Control Centre will be turned off.

6. COMMISSIONING

6.1 Refer to Appendix 1, Hay Street Telemetry factory Acceptance Test Plan.

As a matter of procedure, stocks should be checked on Thursdays and arrangements made to avoid weekend deliveries. Elite tankers hold 6,000 litres, more than adequate for the 1,500 litre capacity of the Hay Street tanks.

The tanker is equipped with a transfer pump, powered from the 240V GPO inside the chloramination building, and a length of 50 mm flexible hose from the pump discharge. The delivery end of the hose has a quick shut off ball valve and camlock fitting allowing connection to the chemical tank fill point.

On arrival the driver must park the tanker in the bunded area beside the building and then close the gate valve which drains the sump at the low end of the driveway. Any small spillages will then be contained in the sump and recovered (by Council personnel), thus preventing contamination of the creek which borders the property.

The driver then unlocks and enters the building, plugs in the pump lead and connects the hose to the appropriate tank.

Before commencing chemical transfer the driver should test the safety shower/eye wash unit, start the ventilation fans and check that the tanks and pumping equipment are all in good working order with no major leaks. The pump can then be started. The driver must stay beside the tank being filled until it reaches the high level mark on the sight glass, whereupon he closes his fill valve and switches off the pump. After closing the fill valve attached to the tank he can then disconnect his hose ensuring that any residual liquid drains into the bucket provided. This can periodically be emptied into the storage tank.

The driver then switches off lights, fans, locks the building door and re-opens the sump drain valve, assuming there has been no chemical spillage. He must then fill out the delivery check sheet (see Appendix 1) which is phoned (or faxed) to Newstead upon his return to the home depot. Newstead operators then have a record of delivery volume and any problems requiring attention at the Hay Street facility.

4 INSTALLATION - N/A

7. OPERATIONS

7.1 Chloramination Dosing System

The facility will be able to operate in either of two (2) states, selectable from a three position (Local/Off/Remote) switch mounted on the Dosing Pumps Starter panel located in the Chloramination Building. The two (2) states are

- Remote (automatic operation), and
- Local (manual operation)

7.1.2 'Remote' State

This state is the Chloramination system normal operation mode. In 'remote' state:

- The start/stop commands for the dosing system comes from the Central Control Room at Newstead (note: two start/stop push-buttons on the Dosing Pumps Starter Panel labelled as 'remote test start' and 'remote test stop' will simulate the remote start/stop commands to test the dosing sequences).

- The start/stop commands will initiate the dosing system Start Sequence or Stop Sequence as explained in sections 5.1 and 5.2

- The Dosing Pumps and electrically actuated tank outlet valves will be controlled by the Chloramination RTU located in the Chloramination Building, with the Operator interface being through the telemetry system from Central Control Room at Newstead.

- All push-buttons associated with the control of the Dosing Pumps and tank outlet valves on the Dosing Pumps Starter Panel are inactive (except for Fault reset and remote test push-buttons).

Note: for 'remote' operation of the dosing system, the manual valves at the suction and discharge side of both Dosing Pumps must be fully open. In 'remote' state:

- Should the operating Hypo dosing pump enter a fault condition, the Ammonium dosing pump will stop automatically and if Ammonium dosing system becomes faulty or unavailable, the Hypo dosing system will stop operation.

- Should the free surface level in one of the storage tanks drops below a low set-point, the RTU will generate an alarm and for a further low-low level the entire dosing systems will enter fault condition and will shut down.

Through the telemetry system, the Newstead Operator will be able to instruct the RTU for start or stop the chloramination process (dosing system);

The operator will also monitor the tank levels, pumps status, tank outlet valves positions, dosing rate and pump station outlet potable water flow rate.

In 'remote' state the following interlocks will apply and any of the interlocks will shut down the dosing system:

- Interlock 11: Should the pump station outlet flow drops to a minimum flow;
- Interlock 12: Should the Ammonium Sulphate discharge pressure drops below a certain limit while the Ammonium Dosing Pump is operating;
- Inter lock 13: Should the Hypo discharge pressure drops below a certain limit while the Hypo Dosing Pump is operating;
- Interlock 14: Should the Hypo Tank low-low level is detected;
- Interlock 15: Should the Ammonium Tank low-low level is detected;
- Interlock 16: Should the Hypo Tank rate of drop rises above a limit;
- Interlock 17: Should the Ammonium Tank rate of drop rises above a limit;
- Interlock 18: Should the Hypo Bund level switch detects liquid in the bund;
- Interlock 19: Should the Ammonium Bund level switch detects liquid in the bund;

7.1.3 'Local' State

In 'local' state, the following apply:

- Operator will have manual control of all of the Chloramination Dosing System equipment using push-buttons mounted on the Dosing Pumps Starter Panel located in the
- All push-buttons associated with the control of the Dosing Pumps and tank outlet valves will be active. The Operator will have the ability to run the system out of sequence and without functional inhibits and interlocks.
- The ON/OFF selector switch for each pump will enable starting or stopping of the pumps via the RTU and motor speed will be adjustable via a potentiometer mounted on the Dosing Pumps Starter Panel to dose the desired rates by the operator.
- The 'remote test start' and 'remote test stop' push-buttons will be inactive.

The RTU will operate each device individually when its operating push-button is activated and the system will be totally manual controlled.

7.1.4 Storage Tanks Solenoid Outlet Valves

The storage tanks Outlets Valves will be water hydraulics operated by an electrically actuated solenoid. Each tank's Outlet valve will have one Open and one Close push button on the Chloramination Control Centre. They will be active only when the Chloramination system Selector Switch is in the LOCAL position. This will allow the valves to be opened or closed by their control push-buttons. The electric actuators will operate in the following manner:

- When the 'valve open' RTU pulse signal is received, the valve will travel to fully open.
- When the 'valve close' RTU pulse signal is received, the valve will travel to fully closed.
- RTU outputs 'valve open' and 'valve close' will be programmed not to be on at the same time, but if both push-buttons are depressed simultaneously, the valve will not operate.
- The valve's status will be displayed as either open or closed. If both signals are active for 5 seconds the valve will be in fault condition and an alarm will be generated.

The malfunction of any valve actuator will provide an alarm and will require a corrective action.

7.2 Flowmeter

The existing Dall Flowmeter on the pump station outlet water main will be used to provide a 4-20 mA analogue signal to be used for setting the dosing pumps speed and also for indication of the pump station outlet flow locally and at Newstead.

7.3 Instrumentation

7.3.1. Storage Tanks Level Transmitters

One (1) level transmitter installed on each of the Storage Tank Nrs 1 and 2 will monitor the chemical free surface levels in the tanks.

Each level transmitter will have the following set points:

- Tank level high: this set point will generate an alarm to warn about over topping of the tank;
- Tank level rate of drop: if the tank level drops at a higher rate than the dosing drop rate, this will indicate a leak on the tank or a pipe burst and as soon as this alarm is detected, the RTU will stop the dosing system and close the tank outlet valve;
- Tank level low: this set point will generate an alarm in a level that there is enough chemical for one day of use and the operator will b e required to fill the tank before the system shuts down;
- Tank level low-low: this set point will generate an alarm when the tank is empty and will shut down the dosing system;

Depending on the free-surface level of the chemical, each tank may be in two states at any one time:

- 'available' or
- 'unavailable',

Each condition of the tank under each state is described as follows:

- 'Available' — The chemical free-surface level is above the low set-point and the tank is ready to be used or is being used.
- 'Un-available' — The chemical free-surface level is below the low - low set-point and the tank low-low level flag from the RTU to the Telemetry is on.

  When a tank becomes 'unavailable' whilst 'on-line', the RTU will stop the dosing pump and close the tank outlet valve and generate tank low-low alarm.

Storage tanks controls & indication

- Low Level indication.
- Outlet Valves: OPEN, CLOSED, FAULT indication.
- Outlet Valves: OPEN and CLOSE push-buttons.

Dosing system

- 'remote test start' and 'remote test-stop' push-buttons.
- Hay Street Pump Station outlet flow indication.

The RESET push-button for fault resetting and status indicating lights will be active irrespective of the operating 'state' of the system.

7.5 Other operations of the plant.

Further details of operations are identified in the following

- Functional Specifications - Refer Appendix 2
- Tanker Driver Check sheet / Refilling the two storage tanks - Refer Appendix 3
- Manual Startup Procedures - Refer Appendix 4
- System Alarms - Refer Appendix 5
- Dose Rate Calculations - Appendix 6

8. EQUIPMENT MAINTENANCE

8.1 Servicing the Chemical Injection Quills

The quills may become encrusted at the tip and so require periodic cleaning. Precautions must be taken to ensure that personnel are not sprayed with chemical during the servicing procedure which is as follows:

- Inform Newstead that servicing is about to commence.
- Leave dosing pump running.
- Shut pump suction valve to isolate the tank.
- Open clean water flush valve and allow five minutes for dosing line to be completely flushed through to the quill.
- Turn off the pump.
- Disconnect flexible hose connected to the quill.
- Shut loading valve; open ball valve.
- Withdraw quill.
- Clean quill manually or by soaking in dilute hydrochloric acid.

Reinstallation is the reverse of the above procedure. Pressure test the dosing line before restarting the pump.

7.3.2 Dosing Pumps Discharge Header Pressure Transmitters

When dosing is in progress the discharge pressure is required to be within a pre-set (adjustable) range for normal operation, dependant on the pump speed. Pressure transmitters PT-01 and PT-02 will be mounted on the Dosing Pumps Discharge Headers to monitor the pressure.

Unless the pipe between the tank and suction header is blocked, or the manual valve on this pipe is closed, when the Dosing Pump is operating, the discharge pressure transmitter will register a pressure not less than the minimum pressure provided by the pump lowest speed setting.

If any of the pressure transmitters register a low pressure for a pre-set (adjustable) period, whilst the dosing system Is operating, the RTU will generate an alarm and will stop the dosing process.

If any of the pressure transmitters register a pressure higher than the top limit for a pre-set (adjustable) period, whilst the dosing system is operating, the RTU will generate an alarm only.

Note: in 'local' state, the RTU will not stop the Dosing Pumps in the event of low pressure.

7.4 Dosing System Local Control Facilities

Refer to Drawing Nr 486/4/7 - JQOO# *Dosing Pumps Starter Panel General Arrangement*

All equipment associated with the Dosing System's local controls will be connected to the RTU. The indicators and controls for this system will be mounted on the Chloramination Control Centre front door, located in the Chloramination Building.

Dosing Pumps Starter unit will include:

- Pump ON/OFF selector switches and pump RESET push-buttons for local operation of the Dosing Pumps and fault re-setting;
- Control Centre Lamp Test: a three position OFF/NORMAL/TEST Selector Switch will be mounted on the Panel door the test the indication lights and to turn them off.

  NORMAL position - the normal operating position. In this position, all lights will be controlled by the RTU as required and, for alarm signals, the associated indication light will flash with a 0.5 second on/0.5 second off cycle activated by the RTU. For 'fault' signals the light will remain on.

  OFF position - all the RTU indication outputs will be disabled.

  TEST position - the RTU will initiate a sequence of turning on the indication lights for each section of the panel in rotation for 10 seconds and repeating for other section(s) with 0.5 seconds pulsing time intervals. When released, this switch spring returns to the NORMAL position.

- Chloramination Selector Switch LOCAL/OFF/REMOTE;
- Pump Control POWER AVAILABLE, RUNNING and FAULT indication lights;
- Pump speed potentiometer;
- Power supply main switch

8.2 Building Internals and Dosing Equipment

The chloramination facility should be inspected at least on a six monthly basis. The following should be included:

- Inspect the building internals for any sign of physical damage or corrosion. In particular inspect around doorways and hinges, lights and fans, electrical enclosure and bunds.
- Operate the safety shower/eye wash unit and ensure appropriate flow of water is available. Check that all connections seal when the safety shower/eye wash unit is not operated.
- Inspect the tanks and pumps for any sign of leakage or deterioration of fittings.
- Ensure the two exhaust ceiling fans and the one blower fan within the electrical enclosure are operating.
- Inspect the camlock fittings for nitrification. Generally replace the external connection fittings for refilling on a six monthly basis.

Any routine or breakdown maintenance performed on the chemical dosing pumps should be in accordance with the manufacturers manual provided with the equipment.

8.3 Safety and Environmental issues

8.3.1 Handling/Accidental Mixing of Chemicals

Direct mixing of Hypo and Sulphate solutions are to be avoided at all times. If the ammonium sulphate and hypochlorite solutions are accidentally mixed, they will react to produce poisonous chlorine gas. To minimise this risk, the tanks and dosing pumps are installed in separate bunded areas and the dosing lines run in separate underground conduits. In addition the chemical storage tanks have non-identical fill point connection fittings to reduce the risk of the driver transferring chemicals to the wrong tank.

IT IS MOST IMPORTANT THAT GREAT CARE IS TAKEN IN THE OPERATION OF THE EQUIPMENT BY TANKER DRIVERS AND COUNCIL STAFF TO REPLENISH THE CHEMICAL TANKS. CONSEQUENTLY, THE TWO CHEMICALS ARE TOO ALWAYS BE KEPT SEPARATED. THIS MEANS THAT REPLENISHING OF THE CHEMICAL TANKS WILL ONLY BE CARRIED OUT ONE AT A TIME. IT IS ALSO RECOMMENDED THAT MAINTENANCE AND/OR/OPENING UP OF THE PLUMBING AND COMPONENTS SYSTEMS SHOULD ALSO BE CARRIED OUT IN ISOLATION.

SHOULD ACCIDENTAL MIXING OF THE CHEMICALS OCCUR AND CHLORINE GAS IS INVOLVED, THE BUILDING DOORS SHOULD BE OPENED, VENTILATION FANS SWITCHED ON AND THE AREA WASHED OUT WITH THE WATER HOSE PROVIDED.

IF THE SITUATION IS DEEMED TO BE SERIOUS, CALL THE FIRE BRIGADE FOR ASSISTANCE, FOLLOWED BY WS&S SAFETY ADVISER JEFF FOREMAN ON 3403 0272.

8.3.2 Material Safety Data Sheets (MSDS)

Sodium hypochlorite (NaOCl) is an extremely poisonous substance which should be handled in accordance with the instruction contained in the ICI Bulk Installation Guideline for Sodium Hypochlorite (see Appendix 4). Refer to Appendix 8 for the appropriate MSDS.

Ammonium Sulphate ($(NH_4)_2SO_4$) is common fertiliser and presents no real hazard in use as long as it is not ingested or rubbed into the eyes. Refer to Appendix 8 for the appropriate MSDS.

8.3.3 Personal Protection Recommendations

Avoid all skin and eye contact. Wear impervious gloves and goggles. Ensure adequate ventilation and do not enter or remain in the building if there is a strong smell of chlorine.

Wash hands before smoking, eating, drinking or using the toilet. Wash contaminated clothing and protective equipment before storing or re-using.

8.3.4 First Aid

Skin - Immediately wash contaminated skin with plenty of water. Remove contaminated clothing. Wash contaminated clothing before re-use. If swelling, redness, blistering or irritation occurs, seek medical attention.

Eyes - Use the eyewash/safety shower provided. Immediately irrigate the eyes with plenty of water for at least 15 minutes. Eyelids to be held open. Remove contaminated clothing and wash affected skin. Urgently seek medical attention.

Ingestion - Thoroughly rinse mouth with water and give water to drink. DO NOT INDUCE VOMITING. If vomiting occurs, give further water. URGENTLY seek medical attention.

Advice to Doctor - To treat symptomatically and treat as for alkaline material.

8.3.5 Cleanup of Spillages

Spill in Bunded Area - If the spill occurs during the chemical delivery process or from a leaking hose fitting and is contained in the bunded area, then the solution (undiluted) can be returned directly to the particularly chemical tank either by manual baling or with a portable sump pump. If a chemical storage tank develops a leak and requires repair then the tank and bunded area contents may have to be transferred to drums or a tank(er) outside the building. A portable sump pump should be used for this purpose.

Spill in Operating Area - If a spill occurs inside the building but not within the bunded areas, then it may be recovered using absorbent "chemspill" cloth. If the liquid spillage volume is significant then it will flow down the floor waste drain and into the driveway sump. ENSURE THAT THE DRIVEWAY SUMP SLUICE VALVE IS CLOSED. Any spillage or contaminated wash water that is trapped int the driveway sump, will have to be recovered into drums (or similar) by manually baling or using as portable sump pump. The recovered liquids can then be disposed of in a safe manner.

Spill in the Tanker Driveway - The chemical spilled will flow into the driveway sump and be contained. The recovery procedure is the same as described in "Spill in Operating Area.

9 FAULT PROTECTION AND RECTIFICATION

9.1 Refer to Appendix 6 - Chemical Dosing Data Sheet

10 ISOLATION AND RESTORATION N/A

11 LIST OF SUBCONTRACTOR & PROPRIETARY EQUIPMENT N/A

12 RECOMMENDED SPARE PARTS AND TOOLS

12.1 Some fittings loose their strength from premature brittleness caused by continuous exposure to certain chemicals. Consequently, the camlock fittings on the refilling points should be replaced at 6th monthly intervals.

13 LIST OF ENGINEERING DRAWINGS

13.1 The list of engineering drawings are divided into two groups. They include:

- Those drawings supplied by the manufacture (Barrier Engineering and Construction) for construction of the building. Changes made on site have been by pen/hand only. These 17 drawings are numbered from 17357-01 to 17357-11,17357-11A from 17357-12 to 17357-16. Copies are attached within Appendix 9.
- Those drawings supplied by Professional Services Engineering of Brisbane Water for the Chloramination Facility. These 10 drawings are numbered from 486/4/7-JQ001 to JQ007 and JQ011 to JQ013. Copies are attached within Appendix 9.

13.2 The quality control for the design plan through the various stages is also attached in Appendix 9.

14 TRAINING N/A

15 LIST OF CONTRACT VARIATIONS AND PLANT MODIFICATIONS

15.1 Minor modifications were carried out to the approved design and have been reflected in the as constructed drawings:

- Repositioning of wiring conduits on the walls and ceiling for the lights and fans etc.
- Repositioning of the shower cubicle.
- Repositioning of the power and communication cables to the building.
- Tank capacity size is 1100 litres and not 1500 litres due to the way that the sight gauges, drain points and filling points were attached.
- Epoxy coating of the complete wall.

16 COMMISSIONING AND TEST REPORTS

16.1 Supporting documentation includes:

- Factory Acceptance Plan for the Telemetry, refer to Appendix 1.
- Functional Specifications, refer to Appendix 2.
- Chemical Dosing Data Sheet, refer to Appendix 6, parts A,B & C.
- Post Project Review, refer to Appendix 10.

Appendix 1

Hay Street Telemetry Factory Acceptance Test Plan

APPENDIX 1

HAY ST TELEMETRY

FACTORY ACCEPTANCE TEST PLAN

26 August, 1997

1 I/O Listing

The following I/O data will be associated with the Hay St Water Pumping Station MITS RTU.

1.1 Digital Inputs

WSSOCR PRIORITY TIME RESPONSE DEFINITIONS

PRIORITY 1 =IMMEDIATE RESPONSE
PRIORITY 2 =NEXT DAY RESPONSE (By 7.45AM)
PRIORITY 3 =NEXT WORKING DAY RESPONSE (By 7.45 AM next working day)
PRIORITY 0 =NO ALARMING

MODULE ADDRESS	CARD	SLOT	CHAN	DESCRIPTION	STATE (Off / On)
10	1	2	1	RTU Battery Failure	OK / Fail
10	1	2	2	RTU Mains Failure	OK / Fail
10	1	2	3	Attention Alarm Acknowledge Button	Off / Ack
10	1	2	4	Security System Armed	Disarm / Arm
10	1	2	5	Security System Tamper	OK / Tamper
10	1	2	6	Spare	
10	1	2	7	Security Door Limit Switch	Open / Close
10	1	2	8	Station Mains Failure	OK / Fail
10	1	2	9	Pump 1 Run Status	Stop / Run
10	1	2	10	Pump 1 Mains Failure	OK / Fail
10	1	2	11	Pump 1 Local/Remote	Local / Remote
10	1	2	12	cst1mainspower	
10	1	2	13	Spare	
10	1	2	14	Spare	
10	1	2	15	Spare	
10	1	2	16	Spare	

MODULE ADDRESS	CARD	SLOT	CHAN	DESCRIPTION	STATE (Off / On)
11	2	3	1	Pump 2 Run Status	Stop / Run
11	2	3	2	Pump 2 Mains Failure	OK / Fail
11	2	3	3	Pump 2 Local Remote	Local / Remote
11	2	3	4	PLC1 Communications Fault	OK / Fault
11	2	3	5	Station No Pumps Running	No / Yes
11	2	3	6	Station One Pump Running	No / Yes
11	2	3	7	Station Two Pumps Running	No / Yes
11	2	3	8	PLC Fault	OK / Fail
11	2	3	9	Cathodic Protection Door Limit Switch	Open / Close
11	2	3	10	Cathodic Protection Local Reset	Off / Reset
11	2	3	11	Cathodic Protection Mains Failure	OK / Fail
11	2	3	12	Spare	
11	2	3	13	Spare	
11	2	3	14	Spare	
11	2	3	15	Spare	
11	2	3	16	Spare	

MODULE ADDRESS	CARD	SLOT	CHAN	DESCRIPTION	STATE (Off / On)
12	3	4	1	Temperature High alarm	Not High / High
12	3	4	2	Lamp Test Switch Off Selected	Not Off / Off
12	3	4	3	Lamp Test Switch TestSelected	Not Test/ Test

12	3	4	4	Dosing System Selector Switch Local Sel.	Off / Local
12	3	4	5	Dosing System Selector Switch Remote Sel.	Off / Remote
12	3	4	6	Dosing System Remote Start Test	Normal / Start
12	3	4	7	Dosing System Remote Stop Test	Normal / Stop
12	3	4	8	Sodium Hypo Storage Tk Out Valve Open PB	Normal / Open
12	3	4	9	Sodium Hypo Storage Tk Out Valve Close PB	Normal / Close
12	3	4	10	Ammonium Sulph Storage Tk Out Valve Open PB	Normal / Close
12	3	4	11	Ammonium Sulph Storage Tk Out Valve Close PB	Normal / Close
12	3	4	12	Sodium Hypochlorite Dosing Pump Ctl Power Av	OK / Fail
12	3	4	13	Sodium Hypochlorite Dosing Pump Running	Stoped / Runing
12	3	4	14	Sodium Hypochlorite Dosing Pump Fault	OK / Fail
12	3	4	15	Ammonium Sulphate Dosing Pump Ctl Power Av	OK / Fail
12	3	4	16	Ammonium Sulphate Dosing Pump Running	Stoped / Running

MODULE ADDRESS	CARD	SLOT	CHAN	DESCRIPTION	STATE (Off / On)
13	4	5	1	Ammonium Sulphate Dosing Pump Fault	OK / Fail
13	4	5	2	Sodium Hypo Storage Tank Outlet Vlv Fully Open	Not FO / Open
13	4	5	3	Sodium Hypo Storage Tank Outlet Vlv Fully Closed	Not FC / Close
13	4	5	4	Sodium Hypo Bund Level High	OK / High
13	4	5	5	Ammonium Sulphate Storage Tk Outlet Vlv Fully Open	Not FO / Open
13	4	5	6	Ammonium Sulphate Storage Tk Outlet Vlv Fully Close	Not FC / Close
13	4	5	7	Ammonium Sulphate Bund Level High	Normal / Stop
13	4	5	8	Dosing Building Door Limit Switch Operated	Open / Close
13	4	5	9	Spare	
13	4	5	10	Spare	
13	4	5	11	Spare	
13	4	5	12	Spare	
13	4	5	13	Spare	
13	4	5	14	Spare	
13	4	5	15	Spare	
13	4	5	16	Spare	

1.2 Digital Outputs

MODULE ADDRESS	CARD	SLOT	CHAN	DESCRIPTION	STATE (Off / On)
20	1	7	1	Attention Indicator	Off / On
20	1	7	2	Security Audible alarm	OK / Fail
20	1	7	3	Cathodic Protection Reference Electrode Operation	Off / On
20	1	7	4	Run No Pumps PLC	Off / On
20	1	7	5	Run One Pump PLC	Off / On
20	1	7	6	Run Two Pumps PLC	Off / On
20	1	7	7	PLC Watchdog Bit	Off / On
20	1	7	8	Reservoir Level Analog Input Invalid	OK / Fail
20	1	7	9	Cathodic Protection Rectifier Operate	Off / On
20	1	7	10	Cathodic Protection Indicator	Off / On
20	1	7	11	Spare	
20	1	7	12	Spare	
20	1	7	13	Spare	
20	1	7	14	Spare	
20	1	7	15	Spare	
20	1	7	16	Spare	

MODULE ADDRESS	CARD	SLOT	CHAN	DESCRIPTION	STATE (Off / On)
21	2	8	1	Sodium Hypo Dosing Line Pressure Low Indic.	Off / On
21	2	8	2	Ammonium Sulphate Dosing Line Pressure Low Indic.	Off / On
21	2	8	3	Sodium Hypo Storage Tank Outlet Valve Open Indic.	Off / On
21	2	8	4	Sodium Hypo Storage Tank Outlet Valve Close Indic.	Off / On
21	2	8	5	Sodium Hypo Storage Tank Outlet Valve Fault Indic.	Off / On
21	2	8	6	Ammonium Sulph Storage Tk Outlet Valve Open Indic	Off / On
21	2	8	7	Ammonium Sulph Storage Tk Outlet Valve Closed Ind	Off / On
21	2	8	8	Ammonium Sulph Storage Tk Outlet Valve Fault Indic	Off / On
21	2	8	9	Sodium Hypo Dosing Pump Available Indication	Off / On
21	2	8	10	Sodium Hypo Dosing Pump Running Indication	Off / On
21	2	8	11	Sodium Hypo Dosing Pump Fault Indication	Off / On
21	2	8	12	Ammonium Sulph Dosing Pump Available Indication	Off / On
21	2	8	13	Ammonium Sulph Dosing Pump Running Indication	Off / On
21	2	8	14	Ammonium Sulph Dosing Pump Fault Indication	Off / On
21	2	8	15	Sodium Hypochlorite Dosing Pump Run	Stop / Start
21	2	8	16	Ammonium Sulphate Dosing Pump Run	Stop / Start

MODULE ADDRESS	CARD	SLOT	CHAN	DESCRIPTION	STATE (Off / On)
22	3	9	1	Dosing Pumps Speed High	Normal/2600rpm
22	3	9	2	Dosing Pumps Speed Low	Normal/ 1900rpm
22	3	9	3	Dosing Pumps Fault Reset	Normal/ 1900rpm
22	3	9	4	Sodium Hypo Storage Tk Outlet Vlv Actuator Open	Not Open / Open
22	3	9	5	Sodium Hypo Storage Tk Outlet Vlv Actuator Closed	NotClose/ Close
22	3	9	6	Ammonium Sulph Storage Tk Out Valve Actuator Open	Not Open / Open
22	3	9	7	Ammonium Sulph Storage Tk Out Valve Actuator Closed	NotClose/ Close
22	3	9	8	Tank full audible alarm (either tank > high limit)	Off / On
22	3	9	9	Sodium Hypo Tank Low Level LED	Off / On
22	3	9	10	Ammonium Sulphate Tank Low Level LED	Off / On
22	3	9	11	Spare	
22	3	9	12	Spare	
22	3	9	13	Spare	
22	3	9	14	Spare	
22	3	9	15	Spare	
22	3	9	16	Spare	

1.3 Analog Inputs

MODULE ADDRESS	CARD	SLOT	CHAN	DESCRIPTION	Range
30	1	10	1	Station Flow Rate	0 - ???? L/Sc
30	1	10	2	Station Pressure	0 - ???? kPa
30	1	10	3	Pump No.1 Motor Power	0 - ???? KW
30	1	10	4	Pump No.2 Motor Power	0 - ???? KW
30	1	10	5	Pump No.1 Motor Current	0 - ???? Amps
30	1	10	6	Pump No.1 Motor Current	0 - ???? Amps
30	1	10	7	Spare	
30	1	10	8	Spare	
30	1	10	9	Spare	
30	1	10	10	Cathodic Protection 1 Reference Electrode AI	
30	1	10	11	Cathodic Protection Rectifier Current AI	
30	1	10	12	Cathodic Protection Rectifier Voltage AI	
30	1	10	13	Cathodic Protection 2 Reference Electrode AI	
30	1	10	14	Spare	
30	1	10	15	Spare	

MODULE ADDRESS	CARD	SLOT	CHAN	DESCRIPTION	Range
32	1	11	1	Sodium Hypochlorite Dosing Line Pressure AI	0 - ???? kPa
32	1	11	2	Sodium Hypochlorite Storage Tank Level AI	0 - ???? M
32	1	11	3	Ammonium Sulphate Dosing Line Pressure AI	0 - ???? kPa
32	1	11	4	Ammonium Sulphate Storage Tank Level AI	0 - ???? M
32	1	11	5	Spare	
32	1	11	6	Spare	
32	1	11	7	Spare	
32	1	11	8	Spare	
32	1	11	9	Spare	
32	1	11	10	Spare	
32	1	11	11	Spare	
32	1	11	12	Spare	
32	1	11	13	Spare	
32	1	11	14	Spare	
32	1	11	15	Spare	
32	1	11	16	Spare	

1.4 Analog Outputs

MODULE ADDRESS	CARD	SLOT	CHAN	DESCRIPTION	Range
40	1	12	1	Station 1 Reservoir Level (Grovely)	0 - ???? M
40	1	12	2	Spare	
40	1	12	3	Spare	
40	1	12	4	Spare	
40	1	12	5	Spare	
40	1	12	6	Spare	
40	1	12	7	Spare	
40	1	12	8	Spare	

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Test No.	Test Name	Test Desciption	Test Outcomes (at WSSOCR)	Result Pass/Fail	Test IR No.
2	**I/O Point Tests**				
2.1	**Digital Inputs**				
	Digital Input Point to Point Tests	Perform Point to Point tests on the Hays St Physical digital inputs and ensure correct input is energised			
2.2	**Digital Outputs**				
	Digital Output Point to Point Tests	Perform Point to Point tests on the Hays St Physical digital outputs and ensure correct input is energised			
2.3	**Analog Inputs**				
	Analog Input Point to Point Tests	Inject 4-20mA on the Hays St Physical analog inputs and ensure correct value is read in RTU and WSSOCR.			
2.3.1	Chemical Tank 1 Pressure	Inject 4-20mA	0-100 % scale		
2.3.2	Chemical Tank 1 Level	Inject 4-20mA	0-100 % scale		
2.3.3	Chemical Tank 2 Pressure	Inject 4-20mA	0-100 % scale		
2.3.4	Chemical Tank 2 Level	Inject 4-20mA	0-100 % scale		
3	**Chemical Tank Level Alarm Tests**				
3.1	**Chemical Tank 1 Level**				
3.1.1	Level Invalid Alarm	1. Set input to 0mA 2. Wait 30 seconds	1. Ensure level invalid alarm generated at WSSOCR.	✓	✓
3.1.2	Level Invalid Alarm	1. Set input to 24mA 2. Wait 30 seconds	1. Ensure level invalid alarm generated at WSSOCR.	✓	
		Set cht1LevHighLimit=80%=16.8mA Set cht1LevLowLimit =30% = ~~mA~~ 3.8 2 Set cht1LevLoLoLimit=10%=5.6mA 7.2 4.8			
3.1.3	Level High Alarm	1. Set input to 19mA 4 2. Wait 30 seconds	1. Ensure level high alarm generated at WSSOCR.	✓	
3.1.4	Level Low Alarm	1. Set input to ~~6mA~~ 8 7.6 2. Wait 30 seconds	1. Ensure level low alarm generated at WSSOCR.	✓	
3.1.5	Level LowLow Alarm	1. Set input to ~~5mA~~ 5 2. Wait 30 seconds	1. Ensure level low low alarm generated at WSSOCR.	✓	
3.1.6	Level No Pumps Running Rate of Change alarm	1. Ensure no pumps running 2. Set input to 12mA 3. Wait 10 minutes 4. Set input to ~~11mA~~ 11.5	1. Ensure level ROC No Pumps Running flag set. 2. Ensure level ROC alarm received at WSSOCR.	✓	5% in one [redacted] hour R.O.C.

Test No.	Test Name	Test Desciption	Test Outcomes (at WSSOCR)	Result Pass/Fail	Test IR No.
3.1.7	Level Low Speed Pumps Running Rate of Change alarm 10% in one	1. Ensure pumps running on Low Speed 2. Set input to ~~11mA~~ 11.5mA 3. Wait 10 minutes 4. Set input to ~~9mA~~ 11mA	1. Ensure level ROC Low Speed Running flag set. 2. Ensure level ROC alarm received at WSSOCR.	✓	10% in one hour ✓
3.1.8	Level Rate of Change alarm ~~Hi Speed~~ 20% in one hour with pumps on Hi Speed	1. Set input to ~~9mA~~ 11mA 2. Wait 10 minutes 3. Set input to ~~5mA~~ 10mA	1. Ensure level ROC flag set. 2. Ensure level ROC alarm received at WSSOCR.	✓	
3.2	**Chemical Tank 2 Level**				
3.2.1	Level Invalid Alarm	1. Set input to 0mA 2. Wait 30 seconds	1. Ensure level invalid alarm generated at WSSOCR.		✓
3.2.2	Level Invalid Alarm	1. Set input to 24mA 2. Wait 30 seconds	1. Ensure level invalid alarm generated at WSSOCR.		
		Set cht2LevHighLimit=80%=16.8mA Set cht2LevLowLimit = 20% = 7.2mA Set cht2LevLoLoLimit=10%=5.6mA			
3.2.3	Level High Alarm	1. Set input to 19mA 2. Wait 30 seconds	1. Ensure level high alarm generated at WSSOCR.		✓
3.2.4	Level Low Alarm	1. Set input to 6mA 2. Wait 30 seconds	1. Ensure level low alarm generated at WSSOCR.		
3.2.5	Level LowLow Alarm	1. Set input to 5mA 2. Wait 30 seconds	1. Ensure level low low alarm generated at WSSOCR.		
3.2.6	Level No Pumps Running Rate of Change alarm	1. Ensure no pumps running 2. Set input to 12mA 3. Wait 10 minutes 4. Set input to 11mA	1. Ensure level ROC No Pumps Running flag set. 2. Ensure level ROC alarm received at WSSOCR.		✓
3.2.7	Level Low Speed Pumps Running Rate of Change alarm	1. Ensure pumps running on Low Speed 2. Set input to 11mA 3. Wait 10 minutes 4. Set input to 9mA	1. Ensure level ROC Low Speed Running flag set. 2. Ensure level ROC alarm received at WSSOCR.		✓
3.2.8	Level Rate of Change alarm	1. Set input to 9mA 2. Wait 10 minutes 3. Set input to 5mA	1. Ensure level ROC flag set. 2. Ensure level ROC alarm received at WSSOCR.		
3.3	**Chemical Tank 1 Pressure**				
	Start Dosing System				
3.3.1	Pressure Invalid Alarm	1. Set input to 0mA 2. Wait 30 seconds	1. Ensure Pressure invalid alarm generated at WSSOCR ensure system shutdown.		

* ch2level invalid time xxxldly = 1m NOT 10m !!

* StopTest FG should also reset shutdown bit

* Add CR Dosing Shutdown to ...

Test No.	Test Name	Test Desciption	Test Outcomes (at WSSOCR)	Result Pass/Fail	Test IR No.
3.3.2	Pressure Invalid Alarm	1. Set input to 24mA 2. Wait 30 seconds	1. Ensure Pressure invalid alarm generated at WSSOCR ensure system shutdown.		✓
		Set cht1PmpDischPrHiLm = 80% = 16.8mA Set cht1PmpDischPrLoLm=10%=5.6mA			
3.3.3	Pressure High Alarm	1. Set input to 19mA 2. Wait 30 seconds	1. Ensure Pressure high alarm generated at WSSOCR.		✓
3.3.4	Pressure Low Alarm	1. Set input to 6mA 2. Wait 30 seconds	1. Ensure Pressure low alarm generated at WSSOCR and system shutdown.		✓
3.4	**Chemical Tank 2 Pressure**				
	Start Dosing System				
3.4.1	Pressure Invalid Alarm	1. Set input to 0mA 2. Wait 30 seconds	1. Ensure Pressure invalid alarm generated at WSSOCR ensure system shutdown.		✓
3.4.2	Pressure Invalid Alarm	1. Set input to 24mA 2. Wait 30 seconds	1. Ensure Pressure invalid alarm generated at WSSOCR ensure system shutdown.		
		Set cht1PmpDischPrHiLm = 80% = 16.8mA Set cht1PmpDischPrLoLm=10%=5.6mA			
3.4.3	Pressure High Alarm	1. Set input to 19mA 2. Wait 30 seconds	1. Ensure Pressure high alarm generated at WSSOCR.		
3.4.4	Pressure Low Alarm	1. Set input to 6mA 2. Wait 30 seconds	1. Ensure Pressure low alarm generated at WSSOCR and system shutdown.		
3.5	**Dosing Pump Faults**				
	Start Dosing System				
3.5.1	Cht1 Dosing Pump Power Sodium Hypo	1. Set cht1DosPmpPower DI = Off	1. Ensure Dosing Pump alarm generated and ensure system shutdown with alarm at WSSOCR.		✓
3.5.2	Cht2 Dosing Pump Power Ammonium Sulphate	1. Set cht2DosPmpPower DI = Off	1. Ensure Dosing Pump alarm generated and ensure system shutdown with alarm at WSSOCR.		✓
3.5.3	Cht1 Dosing Pump Fault Sodium Hypo	1. Set cht1DosPmpFault DI = On	1. Ensure Dosing Pump alarm generated and ensure system shutdown with alarm at WSSOCR.		

Test No.	Test Name	Test Desciption	Test Outcomes (at WSSOCR)	Result Pass/Fail	Test IR No.
3.5.4	Cht2 Dosing Pump Fault Ammonium Sulphate	1. Set cht2DosPmpFault DI = On	1. Ensure Dosing Pump alarm generated and ensure system shutdown with alarm at WSSOCR.		✓
3.5.5	Cht1 Dosing Pump Fail to Run Sodium Hypo	1. Set Dosing Pump Running w/o feedback	1. Ensure Dosing Pump alarm generated and ensure system shutdown with alarm at WSSOCR.		
3.5.6	Cht2 Dosing Pump Fail to Run Ammonium Sulphate	1. Set Dosing Pump Running w/o feedback	1. Ensure Dosing Pump alarm generated and ensure system shutdown with alarm at WSSOCR.		✓
3.6	**Valve Controls**				
	Start Dosing System				
3.6.1	Sodium Hypo Valve Control Fail alarm Fail to Fully Open	1. Set cht1OutVlvOpClEn DO = On 2. Remove Fully Opened Feedabck D/I 3. Wait 1 minute	1. Ensure internal valve control fail alarm generated and Dosing System shutdown with alarm at WSSOCR.		
3.6.2	Ammonium Sulphate Valve Control Fail alarm Fail to Fully Open	1. Set cht2OutVlvOpClEn DO = On 2. Remove Fully Opened Feedabck D/I 3. Wait 1 minute	1. Ensure internal valve control fail alarm generated and Dosing System shutdown with alarm at WSSOCR.		
3.6.3	Sodium Hypo Valve Control Fail alarm Fail to Fully Close	1. Set cht1OutVlvOpClEn DO = Off 2. Remove Fully Closed Feedabck D/I 3. Wait 1 minute	1. Ensure internal valve control fail alarm generated and Dosing System shutdown with alarm at WSSOCR.		
3.6.4	Ammonium Sulphate Valve Control Fail alarm Fail to Fully Close	1. Set cht2OutVlvOpClEn DO = Off 2. Remove Fully Closed Feedabck D/I 3. Wait 1 minute	1. Ensure internal valve control fail alarm generated and Dosing System shutdown with alarm at WSSOCR.		
3.7	**Dosing Rate Controls**				
3.7.1	No dosing required	1. Set flw1flowRateAI = 7mA approx 85L/s 2. Wait for 10 minutes	1. Ensure dosing system does not start and neither the Dosing Low or Dosing High internal bits are set.		
3.7.2	Low Speed dosing required	1. Set flw1flowRateAI = 14mA approx 285L/s	1. Ensure dosing system starts and the Dosing System is on Low.		
3.7.3	High Speed dosing required	1. Set flw1flowRateAI = 19mA approx 428L/s	1. Ensure dosing system continues to run and the Dosing System is on High Speed.		
3.7.4	Low Speed dosing required	1. Set flw1flowRateAI = 15mA approx 315L/s	1. Ensure dosing system continues to run and the Dosing System is on Low Speed.		✓

Test No.	Test Name	Test Desciption	Test Outcomes (at WSSOCR)	Result Pass/Fail	Test IR No.
3.8	**Bund Level High Faults**				
	Start Dosing System				
3.8.1	Sodium Hypo Bund Level Hi	1. Set cht1BundLevHigh DI = On	1. Ensure Dosing System shutdown with alarm at WSSOCR.		✓
3.8.2	Ammonium Sulphate Bund Level Hi	1. Set cht2BundLevHigh DI = On	1. Ensure Dosing System shutdown with alarm at WSSOCR.		✓
3.9	**Test Mode Control**				
3.9.1	Test Start Push Button	1. Set selector switch to Local 2. Ensure other parameters are OK for dosing system to start ie flow > 250 L/S , chtDosWSSOCRAv=1 etc etc 3. Press Test Start PB	1. Ensure dosing system does not start.		✓
3.9.2	Test Start Push Button	1. Set selector switch to Remote 2. Press Test Start PB	1. Ensure dosing system starts.		✓
3.9.3	Test Stop Push Button	1. Press Test Stop PB	1. Ensure dosing system stops.		✓
3.10	**Local Mode Control**				
3.10.1	Local Control	1. Set selector switch to Local 2. Press cht1VlvOpenPB	1. Ensure valve opens.		✓
3.10.2	Local Control	1. Set selector switch to Local 2. Press cht2VlvOpenPB	1. Ensure valve opens.		✓
3.10.3	Local Control	1. Set selector switch to Local 2. Press cht1VlvClosPB	1. Ensure valve closes.		✓
3.10.4	Local Control	1. Set selector switch to Local 2. Press cht2VlvClosPB	1. Ensure valve closes.		✓
3.11	**Miscellaneous Faults**				
3.11.1	Building Door Switch	1. Set cht1BuildDoorSw DI = On	1. Ensure RTU Internal alarm is generated.		✓
3.11.2	Temperature High alarm	1. Set chtTempHiAlarm DI = On	1. Ensure RTU Internal alarm is generated.		
3.11.3	Local Selector Switch	1. Set selector switch to Local.	1. Ensure RTU Internal bit chtLocal is set. ChtRemote is Off ChtOff is Off		
3.11.4	Remote Selector Switch	1. Set selector switch to Remote.	1. Ensure RTU Internal bit chtRemotel is set. ChtLocal is Off ChtOff is Off		
3.11.5	Off Selector Switch	1. Set selector switch to Off.	1. Ensure RTU Internal bit chtOff is set. ChtLocal is Off ChtRemote is Off		
3.11.6	Testl.amp Test LED Control	1. Set Lamp Test Switch On	1. Ensure LEDs flash at appropriate rate. Half on half off.		

Test No.	Test Name	Test Desciption	Test Outcomes (at WSSOCR)	Result Pass/Fail	Test IR No.

Appendix 2

Functional Specifications

APPENDIX 2

BRISBANE CITY COUNCIL

Brisbane Water
Technology Services Branch
Asset Management Professional Services

Author: Gerard Anderson,
Document ID: **Hay St Chloramination Functional Specification**
***Definitive 1.0** - 21 August 1998*

Jim Karydas	Signed:_____	Date:_____
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FILE: G:\TSITOP\SYSTEM\mits\hayst\documentation\hayst.d10

Executive Summary

The purpose of this document is to describe the Functional Requirements of the Hay St Chloramination Unit. The Hay St Water pump station is feeding part of the Brisbane northern suburban water reticulation system suplied from North Pine Water Treatment Plant. During certain periods of the year the water reticulation chlorine levels may be insufficient to prevent growth of certain organisms. Chloramination of the water at some sections of the reticulation has been found to be useful to disinfect these organisms. The local chloramination facility at Hay St will operate as a supplement to the same facility at the treatment plant in order to enhance the water quality. It incorporates Sodium Hypochlorite (Hypo) and Ammonium Sulphate dosing systems. Each of the chemicals is contained within a 1500L tank with pipework connected to a positive displacement dosing pump which pumps the chemicals through dosing lines up to the injection points. The objective of the Chloramination project at Hay St Mitchelton is to maintain adequate chloramine residuals of 1.5mg/L at all points of the reticulation system to control nitrite within acceptable limits.

The two chemical tanks dose at different rates and enter the water mains at opposite ends of the pump station. Each tanks dosing rate is controlled by a variable speed drive which has two speed settings. It is dangerous to dose one chemical without the other therefore the system will shutdown if either level reaches the Low Low alarm point.

The system may be reset onsite by pressing the station STOP Pushbutton located on the chemical dosing switchboard in the chemical dosing building.

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Hay St Water Pumping Station
Chemical Dosing System
Data Sheet

Sodium Hypochlorite Tank	Ammonium Sulphate Tank
Diameter : 1100mm +/- 3%	Diameter : 1100mm +/- 3%
Total Volume = 1500L	Total Volume = 1500L
Workable volume = 1140L Workable Level Range : 0 - 1.2M	Workable volume = 1140L Workable Level Range : 0 - 1.2M
Dosing Rate Hi Speed : 26.9 L/Hr Dosing Rate Low Speed :17.9 L/Hr	Dosing Rate Hi Speed : 21 L/Hr Dosing Rate Low Speed :14 L/Hr
Hi Level Alarm : 95% Low Level Alarm : 25% Low Low Level alarm : 5%	Hi Level Alarm : 95% Low Level Alarm : 25% Low Low Level alarm : 5%

NB The dosing system will shutdown when either of the two tanks Low Low level alarm is reached. The dosing system will still operate if a High or Low level alarm is active on either tank.

In the interim all **shutdown** alarms have been OR-ed into a single alarm point called "Chemical Tank Mains Fail Alarm" on the MITS database. If this alarm is active then it could be anything from a Level Low Low Alarm to Bund Level High Alarm. In order in the interim to determine which alarm is active at any given time (providing it does not appear on the LEDs in the chemical dosing switchboard) you will have to access the Isagraf code online.

Acronyms

EFPS	Eagle Farm Pump Station
IDTS	Integrated Departmental Telemetry System
MTBF	Mean Time Between Failure
WSSOCR	Water & Sewerage Systems Operational Control Room

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1 Introduction

When the term CROFF or operator is used, this shall mean the Control Room Officer at the Water and Sewerage systems Operations Control Room (WSSOCR) unless otherwise specified. When the term cht1 is used, this shall mean the Sodium HypoChlorite Chemical Tank. When the term cht2 is used, this shall mean the Ammonium Sulphate Chemical Tank.

In all control algorithms, PS denotes the present state that the Flag, Counter etc. is in. S0, S1 etc. are the states that the Flag, Counter etc. can be in. The conditions that cause state transitions are denoted as C1...Cn.

1.1 Acronyms

cht1	Sodium HypoChlorite Chemical Tank 1 (Hypo)
cht2	Ammonium Sulphate Chemical Tank 2 (Sulphate)
CROFF	Control Room Officer
WSSOCR	Water Supply and Sewerage Operations Control Room

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2 I/O Listing

The following I/O data will be associated with the Hay St Water Pumping Station MITS RTU.

2.1 Digital Inputs

WSSOCR PRIORITY TIME RESPONSE DEFINITIONS

PRIORITY 1 =IMMEDIATE RESPONSE
PRIORITY 2 =NEXT DAY RESPONSE (By 7.45AM)
PRIORITY 3 =NEXT WORKING DAY RESPONSE (By 7.45 AM next working day)
PRIORITY 0 =NO ALARMING

MODULE ADDRESS	CARD	SLOT	CHAN	DESCRIPTION	STATE (Off / On)
10	1	2	1	RTU Battery Failure	OK / Fail
10	1	2	2	RTU Mains Failure	OK / Fail
10	1	2	3	Attention Alarm Acknowledge Button	Off / Ack
10	1	2	4	Security System Armed	Disarm / Arm
10	1	2	5	Security System Tamper	OK / Tamper
10	1	2	6	Spare	
10	1	2	7	Security Door Limit Switch	Open / Close
10	1	2	8	Station Mains Failure	OK / Fail
10	1	2	9	Pump 1 Run Status	Stop / Run
10	1	2	10	Pump 1 Mains Failure	OK / Fail
10	1	2	11	Pump 1 Local/Remote	Local / Remote
10	1	2	12	cst1mainspower	
10	1	2	13	Spare	
10	1	2	14	Spare	
10	1	2	15	Spare	
10	1	2	16	Spare	

MODULE ADDRESS	CARD	SLOT	CHANNEL	DESCRIPTION	STATE (Off / On)
11	2	3	1	Pump 2 Run Status	Stop / Run
11	2	3	2	Pump 2 Mains Failure	OK / Fail
11	2	3	3	Pump 2 Local Remote	Local / Remote
11	2	3	4	PLC1 Communications Fault	OK / Fault
11	2	3	5	Station No Pumps Running	No / Yes
11	2	3	6	Station One Pump Running	No / Yes
11	2	3	7	Station Two Pumps Running	No / Yes
11	2	3	8	PLC Fault	OK / Fail
11	2	3	9	Cathodic Protection Door Limit Switch	Open / Close
11	2	3	10	Cathodic Protection Local Reset	Off / Reset
11	2	3	11	Cathodic Protection Mains Failure	OK / Fail
11	2	3	12	Spare	
11	2	3	13	Spare	
11	2	3	14	Spare	
11	2	3	15	Spare	
11	2	3	16	Spare	

MODULE ADDRESS	CARD	SLOT	CHAN	DESCRIPTION	STATE (Off / On)
12	3	4	1	Temperature High alarm	Not High / High
12	3	4	2	Lamp Test Switch Off Selected	Not Off / Off

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12	3	4	3	Lamp Test Switch TestSelected	Not Test/ Test
12	3	4	4	Dosing System Selector Switch Local Sel.	Off / Local
12	3	4	5	Dosing System Selector Switch Remote Sel.	Off / Remote
12	3	4	6	Dosing System Remote Start Test	Normal / Start
12	3	4	7	Dosing System Remote Stop Test	Normal / Stop
12	3	4	8	Sodium Hypo Storage Tk Out Valve Open PB	Normal / Open
12	3	4	9	Sodium Hypo Storage Tk Out Valve Close PB	Normal / Close
12	3	4	10	Ammonium Sulph Storage Tk Out Valve Open PB	Normal / Close
12	3	4	11	Ammonium Sulph Storage Tk Out Valve Close PB	Normal / Close
12	3	4	12	Sodium Hypochlorite Dosing Pump Ctl Power Av	OK / Fail
12	3	4	13	Sodium Hypochlorite Dosing Pump Running	Stoped / Runing
12	3	4	14	Sodium Hypochlorite Dosing Pump Fault	OK / Fail
12	3	4	15	Ammonium Sulphate Dosing Pump Ctl Power Av	OK / Fail
12	3	4	16	Ammonium Sulphate Dosing Pump Running	Stoped / Running

MODULE ADDRESS	CARD	SLOT	CHAN	DESCRIPTION	STATE (Off / On)
13	4	5	1	Ammonium Sulphate Dosing Pump Fault	OK / Fail
13	4	5	2	Sodium Hypo Storage Tank Outlet Vlv Fully Open	Not FO / Open
13	4	5	3	Sodium Hypo Storage Tank Outlet Vlv Fully Closed	Not FC / Close
13	4	5	4	Sodium Hypo Bund Level High	OK / High
13	4	5	5	Ammonium Sulphate Storage Tk Outlet Vlv Fully Open	Not FO / Open
13	4	5	6	Ammonium Sulphate Storage Tk Outlet Vlv Fully Close	Not FC / Close
13	4	5	7	Ammonium Sulphate Bund Level High	Normal / Stop
13	4	5	8	Dosing Building Door Limit Switch Operated	Open / Close
13	4	5	9	Spare	
13	4	5	10	Spare	
13	4	5	11	Spare	
13	4	5	12	Spare	
13	4	5	13	Spare	
13	4	5	14	Spare	
13	4	5	15	Spare	
13	4	5	16	Spare	

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2.2 Digital Outputs

MODULE ADDRESS	CARD	SLOT	CHAN	DESCRIPTION	STATE (Off / On)
20	1	7	1	Attention Indicator	Off / On
20	1	7	2	Security Audible alarm	OK / Fail
20	1	7	3	Cathodic Protection Reference Electrode Operation	Off / On
20	1	7	4	Run No Pumps PLC	Off / On
20	1	7	5	Run One Pump PLC	Off / On
20	1	7	6	Run Two Pumps PLC	Off / On
20	1	7	7	PLC Watchdog Bit	Off / On
20	1	7	8	Reservoir Level Analog Input Invalid	OK / Fail
20	1	7	9	Cathodic Protection Rectifier Operate	Off / On
20	1	7	10	Cathodic Protection Indicator	Off / On
20	1	7	11	Spare	
20	1	7	12	Spare	
20	1	7	13	Spare	
20	1	7	14	Spare	
20	1	7	15	Spare	
20	1	7	16	Spare	

MODULE ADDRESS	CARD	SLOT	CHAN	DESCRIPTION	STATE (Off / On)
21	2	8	1	Sodium Hypo Dosing Line Pressure Low Indic.	LED Off / LED On
21	2	8	2	Ammonium Sulphate Dosing Line Pressure Low Indic.	LED Off / LED On
21	2	8	3	Sodium Hypo Storage Tank Outlet Valve Open Indic.	LED Off / LED On
21	2	8	4	Sodium Hypo Storage Tank Outlet Valve Close Indic.	LED Off / LED On
21	2	8	5	Sodium Hypo Storage Tank Outlet Valve Fault Indic.	LED Off / LED On
21	2	8	6	Ammonium Sulph Storage Tk Outlet Valve Open Indic	LED Off / LED On
21	2	8	7	Ammonium Sulph Storage Tk Outlet Valve Closed Ind	LED Off / LED On
21	2	8	8	Ammonium Sulph Storage Tk Outlet Valve Fault Indic	LED Off / LED On
21	2	8	9	Sodium Hypo Dosing Pump Available Indication	LED Off / LED On
21	2	8	10	Sodium Hypo Dosing Pump Running Indication	LED Off / LED On
21	2	8	11	Sodium Hypo Dosing Pump Fault Indication	LED Off / LED On
21	2	8	12	Ammonium Sulph Dosing Pump Available Indication	LED Off / LED On
21	2	8	13	Ammonium Sulph Dosing Pump Running Indication	LED Off / LED On
21	2	8	14	Ammonium Sulph Dosing Pump Fault Indication	LED Off / LED On
21	2	8	15	Sodium Hypochlorite Dosing Pump Run	Stop / Start
21	2	8	16	Ammonium Sulphate Dosing Pump Run	Stop / Start

MODULE ADDRESS	CARD	SLOT	CHAN	DESCRIPTION	STATE (Off / On)
22	3	9	1	Dosing Pumps Speed High	Normal / 2600rpm
22	3	9	2	Dosing Pumps Speed Low	Normal / 1900rpm
22	3	9	3	Dosing Pumps Fault Reset	Normal / 1900rpm
22	3	9	4	Sodium Hypo Storage Tk Outlet Vlv Actuator Open	Not Open / Open
22	3	9	5	Sodium Hypo Storage Tk Outlet Vlv Actuator Closed	Not Close/ Close
22	3	9	6	Ammonium Sulph Storage Tk Out Valve Actuator Open	Not Open / Open
22	3	9	7	Ammonium Sulph Storage Tk Out Valve Actuator Closed	Not Close/ Close
22	3	9	8	Tank full audible alarm (either tank > high limit)	Off / On
22	3	9	9	Sodium Hypo Tank Low Level LED	LED Off / LED On
22	3	9	10	Ammonium Sulphate Tank Low Level LED	LED Off / LED On
22	3	9	11	Spare	
22	3	9	12	Spare	
22	3	9	13	Spare	
22	3	9	14	Spare	
22	3	9	15	Spare	
22	3	9	16	Spare	

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2.3 Analog Inputs

MODULE ADDRESS	CARD	SLOT	CHAN	DESCRIPTION	Range
30	1	10	1	Station Flow Rate	0 - ???? L/Sc
30	1	10	2	Station Pressure	0 - ???? kPa
30	1	10	3	Pump No.1 Motor Power	0 - ???? KW
30	1	10	4	Pump No.2 Motor Power	0 - ???? KW
30	1	10	5	Pump No.1 Motor Current	0 - ???? Amps
30	1	10	6	Pump No.1 Motor Current	0 - ???? Amps
30	1	10	7	Spare	
30	1	10	8	Spare	
30	1	10	9	Spare	
30	1	10	10	Cathodic Protection 1 Reference Electrode AI	
30	1	10	11	Cathodic Protection Rectifier Current AI	
30	1	10	12	Cathodic Protection Rectifier Voltage AI	
30	1	10	13	Cathodic Protection 2 Reference Electrode AI	
30	1	10	14	Spare	
30	1	10	15	Spare	

MODULE ADDRESS	CARD	SLOT	CHAN	DESCRIPTION	Range
32	1	11	1	Sodium Hypochlorite Dosing Line Pressure AI	0 - ???? kPa
32	1	11	2	Sodium Hypochlorite Storage Tank Level AI	0 - ???? M
32	1	11	3	Ammonium Sulphate Dosing Line Pressure AI	0 - ???? kPa
32	1	11	4	Ammonium Sulphate Storage Tank Level AI	0 - ???? M
32	1	11	5	Spare	
32	1	11	6	Spare	
32	1	11	7	Spare	
32	1	11	8	Spare	
32	1	11	9	Spare	
32	1	11	10	Spare	
32	1	11	11	Spare	
32	1	11	12	Spare	
32	1	11	13	Spare	
32	1	11	14	Spare	
32	1	11	15	Spare	
32	1	11	16	Spare	

2.4 Analog Outputs

MODULE ADDRESS	CARD	SLOT	CHAN	DESCRIPTION	Range
40	1	12	1	Station 1 Reservoir Level (Grovely)	0 - ???? M
40	1	12	2	Spare	
40	1	12	3	Spare	
40	1	12	4	Spare	
40	1	12	5	Spare	
40	1	12	6	Spare	
40	1	12	7	Spare	
40	1	12	8	Spare	

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3 Functional Specification

The following functionality will be associated with the Hay St Water Pumping Station MITS RTU. NB Whener the term cht1 is referred to it

3.1 Chemical Tanks Level M

3.1.1 Functional Description

The chemical tanks (cht1 & cht2) level indication will be checked for validity and averaged over a 10 second rolling average. If the analog value is outside of the 4-20mA range for a period exceeding 5 seconds then this input shall generate an invalid alarm. This alarm will isolate both tanks via the outlet penstock digital outputs and shutdown the dosing system. The level readings will be clamped at the minimum and maximum of the level range with a percentage variance to ensure nuisance alarms are not generated.

3.1.2 Calculation Algorithm

The monitoring and calculation of chemical tank levels will be based on the following calculation algorithm.

```
Every 1 second
    if (NOT C4) then
        chtXsample1 = chtXlevelAI
        chtXsample2 = chtXsample1
        chtXsample3 = chtXsample2
        chtXsample4 = chtXsample3
        chtXsample5 = chtXsample4
        chtXsample6 = chtXsample5
        chtXsample7 = chtXsample6
        chtXsample8 = chtXsample7
        chtXsample9 = chtXsample8
        chtXsample10 = chtXsample9

        chtXlevelAverage = ( chtXsample1 + chtXsample2 +
                  chtXsample3 + chtXsample4 + chtXsample5 +
                  chtXsample6 + chtXsample7 + chtXsample8 +
                  chtXsample9 + chtXsample10 ) / 10
```

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```
    endif

Every 10 seconds :
    chtXlevel = chtXlevelAI

if ( C1 ) then
        chtXlevel = chtXtopWaterLev        clamp top level
endif
if ( C2 ) then
        chtXlevel = chtXbotWaterLev        clamp high level
endif

if ( C3 ) then
        RESET chtXlevelInvalid             within range
endif

if ( not C3 ) then
        SET xxx1dly timer                  start delay timer
endif

if ( C3 ) then
        RESET xxx1dly timer                reset delay timer
endif

if ( ( NOT C3 ) AND C4 ) then
        SET chtXlevelInvalid alarm         out of range
endif

if ( C5 ) then
        SET shutdownDosingsystem
endif

The conditions for the algorithm defined above are as
follows :

C1 : chtXlevelAI == chtXtopWaterLev +/- steXpercent
C2 : chtXlevelAI == chtXbotWaterLev +/- steXpercent
C3 : chtXbotWaterLev-xx1flux <= chtXlevelAI
C4 : xxx1dly      expired                  5 seconds timer
C5 : chtXlevelInvalid set
```

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3.2 Chemical Tanks Level Rate of Change

3.2.1 Functional Description

The cht1 and cht2 level indication will be checked for rate of change alarms. If the rate of change exceeds 30% of full scale reading per hour averaged over a 10 minute period an alarm will be generated for the appropriate tank. If the rate of change exceeds 20% of full scale reading per hour averaged over a 10 minute period, while the pumps are dosing at low speed, an alarm will be generated for the appropriate tank. If the rate of change exceeds 5% of full scale reading per hour averaged over a 10 minute period, while the pumps are not dosing, an alarm will be generated for the appropriate tank. Any of the above alarms will isolate both tanks via the outlet penstock digital outputs and shutdown the dosing system.

Calculation Algorithm

The filtering of reservoir level signals will be based on an algorithm involving calculating a "rolling average" of 10 samples at 1 minute intervals.

3.2.2 Calculation Algorithm

Initialisation: 10 minute rate of change

```
xxxXlevel010 = chtXlevelAverage
xxxXlevel009 = chtXlevelAverage
xxxXlevel008 = chtXlevelAverage
xxxXlevel007 = chtXlevelAverage
xxxXlevel006 = chtXlevelAverage
xxxXlevel005 = chtXlevelAverage
xxxXlevel004 = chtXlevelAverage
xxxXlevel003 = chtXlevelAverage
xxxXlevel002 = chtXlevelAverage
xxxXlevel001 = chtXlevelAverage
xxxXlevel000 = chtXlevelAverage
chtXroc10Minute = 0.0
```

Every 1 minute:

```
xxxXlevel010 = xxxXlevel009
xxxXlevel009 = xxxXlevel008
```

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```
xxxXlevel008 = xxxXlevel007
xxxXlevel007 = xxxXlevel006
xxxXlevel006 = xxxXlevel005
xxxXlevel005 = xxxXlevel004
xxxXlevel004 = xxxXlevel003
xxxXlevel003 = xxxXlevel002
xxxXlevel002 = xxxXlevel001
xxxXlevel001 = xxxXlevel000
xxxXlevel000 = chtXlevelAverage

chtXroc10Minute = (chtXlevel000-chtXlevel010)*(60/10)
                   Metres per hour

if (C1) then                          Check ROC alarms
    SET chtXrocHiSpeAlm alarm
else
    RESET chtXrocHiSpeAlm alarm

if (C2 and C4 and C6 ) then           Check ROC alarms
    SET chtXrocLoSpeAlm alarm
else
    RESET chtXrocLoSpeAlm alarm

if (C3 and not C4) then          Check ROC alarms
    SET chtXrocNoPmpsAlm alarm
else
    RESET chtXrocNoPmpsAlm alarm


C1 :ABS (chtXroc10Minute) > 0.3 * chtXfullLevel
                                  Exceed 30% full-scale/hr
C2 :ABS (chtXroc10Minute) > 0.2 * chtXfullLevel
                                  Exceed 20% full-scale/hr
C3 :ABS (chtXroc10Minute) > 0.05 * chtXfullLevel
                                  Exceed 5% full-scale/hr
C4 :chtnDosPmpRun              (Dosing pumps running)
C5 :chtPmpSpeedHiEn            (Dosing pumps hi speed)
C6 :chtPmpSpeedLoEn            (Dosing pumps lo speed)
```

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3.3 Chemical Tanks Level Alarms

3.3.1 Functional Description

The cht1 and cht2 level indication will be checked for High, Low and Low-Low level alarms. Either tanks Low-Low alarm will isolate both tanks via the outlet penstock digital outputs and shutdown the dosing system. The Low level alarm will drive an output LED on the control panel. Either tanks high level alarm will generate an audible alarm in the chemical dosing room for approximately 2 minutes.

The cht1 & cht2 bund level high switches will generate alarms. Either of these alarms will isolate both tanks via the outlet penstock digital outputs and shutdown the dosing system.

3.3.2 Calculation Algorithm

The calculation of the limit alarms is based on the following algorithm.

```
if (C1) then
        chtXlowLimit = chtXlevelLoDef
        chtXhighLimit = chtXlevelHiDef
endif

if (C2) then
        chtXhighAlarm = 1
endif

if (C4) then
        chtXhighalarm = 0
endif

if (C3) then
        chtXlowAlarm = 1
endif

if (C5) then
        chtXlowAlarm = 0
endif

if (C6) then
```

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```
        chtXloloAlarm = 1
endif

if (C7) then
        chtXloloAlarm = 0
endif

if (C8) then
        chtXbundLevAlarm = 1
endif

if (not C8) then
        chtXbundLevAlarm = 0
endif

if (C10 or C11) then
        chtXLevelLowLED = 1
else
        chtXLevelLowLED = 0
endif

if (C12 and (not C13)) then
        chtXTankFullAudEn = 1
endif

if ((not C12) or C13) then
        chtXTankFullAudEn = 0
endif
```

The conditions for the algorithm defined above are as follows:

```
C1 : xxx1initiate active                    initialisation
C2 : chtXlevelAverage>chtXLevHighLimit  exceeded high limit
C3 : chtXlevelAverage < chtXLevLowLimit exceeded low limit
C4 : chtXlevelAverage < chtXLevHighLimit - steXpercent
C5 : chtXlevelAverage > chtXLevLowLimit + steXpercent
C6 : chtXlevelAverage < chtXLevLoLoLimit   exceeded lolo
                                           limit
C7 : chtXlevelAverage > chtXLevLoLoLimit + steXpercent
C8 : chtXbundLevHigh active
C9 : chtTankFullAudEn
C10: chtXlowAlarm
C11: chtXlowlowAlarm              (Chem Tank lowlow alarm)
```

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```
C12: chtXHighAlarm                (Chem Tank High Alarm)
C13: chtTankAudTim expired        (2 minutes)
```

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3.4 Chemical Tanks Outlet Valve Fault Monitor

3.4.1 Functional Desciption

The cht1 & cht2 tanks each have an outlet valve actuator to automatically isolate each tank when required. These valve actuators come with Fully Open and Fully Closed indication. These valves will each have Fail to Fully Open and Fail to Fully Close alarms generated in the RTU, if requested to open/close and they fail to do so within pre-determined times. Either of these alarms will isolate both tanks via the outlet valve digital outputs and shutdown the dosing system.
During normal operation, the outlet valve status will simply "follow" the valve control i.e., valve status should be consistent with the valve control.

This function monitors inconsistencies between valve controls and current valve status. Inconsistencies between valve control and status will be allowed for a period of time after which it will be flagged as valve failure alarm.

The valve failure alarm will be latched until another control is sent to the valve.

3.4.2 Calculation Algorithm

The valve failure alarm is set/reset according to the following algorithm:

PS: Present State
NS: Next State

S1: Valve is Not Failed
S2: Valve status inconsistent with valve control
S3: Valve is Failed

PS	Conditions	NS	Action
S1	C1 AND (C5 OR C6)	S2	Start fail timer
S2	C1 AND (NOT C5) AND (NOT C6)	S1	Reset fail timer
S2	C1 AND C4	S3	valXctrlFailed = TRUE
S3	C1 AND C7	S1	valXctrlFailed = FALSE

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The conditions for the above algorithm are defined below:

C1:	valXavailableRem	active	Valve available for remote control
C2:	xxx1openControl	active	Valve open control
C3:	xxx1closeControl	active	Valve close control
C4:	xxx1elapseTime	expired	Valve fail timer
C5:	xxx1openControl XOR valXisOpen		Inconsistent valve
C6:	xxx1closeControl XOR valXisClose		status and control
C7:	xxx1openControl(^) OR xxx1closeControl(^)		Valve control initiated

The following is a list of I/O points used by this function:

Code	Point	Description	Type
valXavailableRem	Valve	Available for Remote control	DIT
xxx1openControl	Valve	Open control	Int Reg
xxx1closeControl	Valve	Close control	Int Reg
xxx1elapseTime	Valve	Fail timer	Int Tmr
valXctrlFailed	Valve	Fail alarm	DIP

Alarms generated from this function are as follows:

Code	Alarm	Description	Type
valXctrlFailed	Valve	Fail alarm	DIP

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3.5 Chemical Tanks Discharge Pressure Alarm Monitoring

3.5.1 Functional Desciption

The cht1 & cht2 discharge pressures will be checked for Low pressure alarms. Either of these alarms will isolate both tanks via the outlet penstock digital outputs and shutdown the dosing system. The cht1 & cht2 discharge pressures will be checked for High pressure and alarm only if this occurs.

3.5.2 Calculation Algorithm

The high and low alarm flags (chtXprehighAlarm, chtXprelowAlarm) for the discharge pressure meters shall be set and reset according to the following algorithm:

```
if( C1 ) then
    chtXprelowLimit  = chtXprelevelLoDef
    chtXprehighLimit = chtXprelevelHiDef
endif

if( C2 ) then
    SET chtXprehighAlarm alarm
endif

if( C4 ) then
    RESET chtXprehighAlarm alarm
endif

if( C3 and C6 ) then
    SET chtXprelowAlarm alarm
endif

if( C5 ) then
    RESET chtXprelowAlarm alarm
endif
```

The conditions for the algorithms defined above are as follows:

```
C1: xxx1initiate       active              initialisation
C2: chtXpressureKPA > chtXprehighLimit     above high limit
C3: chtXpressureKPA < chtXprelowLimit      below low limit
C4: chtxpressureKPA < chtXprehighLimit - steXpercent  below
```

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limit buffer
C5: chtXpressureKPA > chtXprelowLimit + setXpercent above limit buffer
C6: chtXDosPmpRunStatus_DI

Related I/O

The following is a list of I/O points used by this function:

Code	Point Description	Type
chtXpressureKPA	Pressure Measure (kPa)	FIP
chtXprealmInhibitTm	Pressure Inhibit Alarm Timer (sec) Int Reg	
chtXprealarmInhibit	Pressure Alarming Inhibited	DIP
chtXprelowAlarm	Pressure Low Alarm Flag	DIP
chtXprehighAlarm	Pressure High Alarm Flag	DIP
xxx1flux	Alarm Limit allowed fluctuations Int Reg	

Generated Alarms

Alarms generated from this function are as follows:

Code	Alarm Description	Type
chtXprelowAlarm	Pressure Low Alarm Flag	DIP
chtXprehighAlarm	Pressure High Alarm Flag	DIP

User Adjustable Parameters

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3.6 Chemical Tanks Dosing Rate Setpoint

3.6.1 Functional Description

The pumping station flowmeter analog input will be used to set the dosing rate of the dosing system. This flowmeter signal will be checked for validity and if found to be invalid will shutdown the dosing system. If level < 250 L/Sc then shutdown dosing system, if level between 250 and 320 L/Sec the dosing level = Lo Speed, if level greater than 320 L/Sec then the dosing level = Hi Speed

3.6.2 Calculation Algorithm

PS: Present State

S0: cht1DosRateLow=0
cht2DosRateLow=0
cht1DosRateHi=0
cht2DosRateHi=0

S1: cht1DosRateLow=1
cht2DosRateLow=1
cht1DosRateHi=0
cht2DosRateHi=0

S2: cht1DosRateLow=0
cht2DosRateLow=0
cht1DosRateHi=1
cht2DosRateHi=1

Current State
S0: if C3 and C5 then Next State = S1
S1: if C4 and C5 then Next State = S2
S2: if C1 or C2 then Next State = S0

The conditions for the state tables defined above are as follows:

C1: DosingSysShutdown (Dosing System Shutdown request)
C2: flw1flowRateAI < chtLowDosLim (Flow < Dosing Limit)
C3: chtHighDosLm > flw1flowRateAI > chtLowDosLm
C4: flw1flowRateAI > chtHighDosLm
C5: flw1flow50_10Min Timer expired (flw1flowRateAI > 50 L/Sc for 10 minutes)

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3.7 Chemical Tanks Dosing System Shutdown

3.7.1 Functional Description

The pumping station flowmeter analog input will be used to set the dosing rate of the dosing system. This flowmeter signal will be checked for validity and if found to be invalid will shutdown the dosing system. The dosing system shutdown will also take place if any of the followng alarms are detected.

3.7.2 Calculation Algorithm

PS: Present State

States
S0: DosingSysShutdown = 0
S1: DosingSysShutdown = 1

Current State S0:
If (not C1) or C2 or (C3) or C5 or C6 or C7 or (C9 and C1) or C10 or C11
Then PS = S1:

Current State S1:
If [(not C2) AND (not C3) AND (not C5) AND (not C6) AND (not C7) AND (not C10) AND (not C11)]
Then PS = S0:

The conditions for the state transitions defined above are as follows:

C1: DosingSysSwRemoteDI (Dosing System Remote)
C2: flw1invalid
C3: chtXBundLevSwDI
C5: chtXDospmpFault
C6: valXctrlFailed
C7: chtXprelowAlarm
C8: DosingSystemRemStartTestDI
C9: DosingSystemRemStopTestDI
C10:cht1LevLoLoAlm
C11:chtXroc30PcntAlm
C12:chtRemoteAv

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3.8 Chemical Tanks System Availability

3.8.1 Functional Description

The Dosing system will be considered available in Local (chtLocalAv) when the Pump Motor Fault Relay is not operated and the Pump Control Power is available.

The Dosing system will be considered available in Remote (chtRemoteAv) when the Selector Switch is in Remote, Pump Motor Fault Relay is not operated, the Pump Control Power is available, Storage Tank Levels are not low, Storage Tank valves are not faulty and the Hay St pump station flow has not been zero for the last 10 minutes.

3.8.2 Calculation Algorithm

The followng algorithm will describe the availability status :

```
S0: chtLocalAv = 0
S1: chtLocalAv = 1

PS=S0 : if (not C1) and C4 then PS = S1
PS=S1 : if C1 or (not C4) then PS = S0

*******************************************************

S0: chtRemoteAv = 0
S1: chtRemoteAv = 1

PS = S0 : if ((not C1) and C5 and C6) then PS=S1
PS = S1 : if ((not C5) or C1 or C3 or C7 or C8) then PS=S0

*******************************************************
```

The conditions for the state transitions defined above are as follows:

```
C1: chtXDosPmpFault
C3: valXctrlFailed
C4: DosingSystemSwLocalDI
C5: DosingSystemSwRemoteDI
C6: flw1flow50_10Min Timer expired    (flw1flowRateAI > 50
```

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Ionics Australasia Pty Ltd
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Lytton Qld 4178
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Tel: 61-7-3893 7560
Fax: 61-7-3393-6071
Sales@ionics.com.au
www.ionics.com

Quotation

TO:	MATTHEW McPHEAT	DATE:	15/12/04
COMPANY:	BRISBANE CITY COUNCIL	FAX NO:	
FROM:	PHILL HAEGENS	PHONE NO:	0416 198 685
EMAIL:	phaegens@ionics.com.au	QUOTE NO:	BRC2522AQUE
SUBJECT:	PVC COMPONENTS	PAGE 1OF:	4

Dear Matt,

In response to your inquiry regarding price and availability for your equipment request, I am pleased to offer the following:

ITEM	CODE / DESCRIPTION	QTY	PRICE EA. A$	TOTAL A$	AVAIL.
A	**G-H1/2-18 /** Pipe Class 18, 15NB Grey PVC	90	6.27 5.70	513.00	Ex-Stock
B	**H1/2-013V /** 90deg Elbow, 15NB Grey PVC	65	1.93 1.75	113.75	Ex-Stock
C	**H1/2-010V** / 45deg Elbow, 15NB Grey PVC	15	3.14 2.85	42.75	1 – 2 Weeks
D	**H1/2-007V /** Coupling, 15NB Grey PVC	10	1.34 1.25	12.50	
E	**H1/2-016V /** Full Face Flange, 15NB Grey PVC	6	9.63 8.75	52.50	
F	**2-15x3-00 /** Gasket, EPDM, to suit H1/2-016V	8	6.49 5.90	47.20	
G	**H1/2-019V /** Tee, 15NB Grey PVC	30	2.31 2.10	63.00	
H	**H1/2-022V** / Union, 15NB Grey PVC	30	6.71 6.10	183.00	2 - 3 Weeks
I	**H1/2-014V /** 90deg Bend, 15NB Grey PVC	10	6.88 6.25	62.50	Ex-Stock
J	**H1/2-017V** / Valve Socket , 15NB x ½" BSPM Grey PVC	20	3.03 2.75	55.00	1 – 2 Weeks
K	**H1/2-101V** / True Union Ball Valve, 15NB Grey PVC Viton	60	35.15 31.95	1917.00	
L	**H1/2-201E /** "Y" Check Valve, EPDM, ½" BSPF Grey PVC	6	73.60 66.910	401.40	
M	**H1/2-GSP-V-G** / Non-Return Valve, Viton, 15NB Grey PVC	6	126.50 115.00	690.00	
N	**H1/2-301E /** "Y" Strainer ½" BSPM Grey PVC	6	58.69 53.35	320.10	
O	**DN8-12 /** Adaptor, DN8 Cap Nut - 15NB SWJF	25	22.00 20	500.00	
P	**DN8-13** / Assembly, DN8 Cap Nut – ½" Hose Tail	10	11.00 10.00	100.00	
Q	**H1/2-110E** / 3 Way True Union Ball Valve, 15NB SWJ Grey PVC	4	92.95 84.50	338.00	

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Thank you.

IONICS

	L1-101V / True Union Ball Valve, 25NB Grey PVC Viton	14	36.60 51.45	720.30	
	L1x1/2-005V / Reducing Bush, 25NB x 15NB, Grey PVC	15	1-76 1.60	24.00	
	25x19-02-CLR / Clear Braided PVC Tubing, 27.5mm OD x 20mm ID	5	6.60 6.00	30.00	
	18x12-02-CLR / Clear Braided PVC Tubing, 18mm OD x 12mm ID	5	4-40 4.00	20.00	
	H1/2x20-050V / Hose Tail, ½" BSPM x 20-22mm Hose, Grey PVC	8	2-31 2.10	16.80	
	H1/2-018G / Faucet Socket, Metal Band, 15NB x ½" BSPF, Grey PVC	15	8.42 7.65	114.75	
	525-0567 / Loading Valve, Adjustable, DN4/8 Grey PVC	5	166.10 151.00	755.00	
	Gemu Rotameter - 85510D3321112 Flow indicator, 4 - 40L/Hr, polypropylene float, PVC SWJF union ends, Viton seals.	2	130.00 143.00	260.00	2 - 3 Weeks
	1000-PVC / Calibration Cylinder, 1000mL, Clear PVC	2	165.00 181.50	330.00	
	Pulsation Dampener – Viton Bladder, 0.2L capacity. 10 Bar Operating pressure.	2	600.00 660.00	1200.00	Ex-Stock
	Pressure Gauge – 0-1000Kpa, 316 Stainless Steel, 65mm Face, PVC Isolation assembly c/w- PTFE Diaphragm.	8	250.00 275.00	2000.00	1 – 2 Weeks
	522-0311 / Dosing Valve, DN4/8 x ½" BSPM	4	70.30 73.00	292.00	
	H1/2x3/8-065V / Reducing Bush, ½" BSPM x 3/8" BSPF, Grey PVC	8	2.15 1.95	15.60	
	16x10-02-CLR / Clear Braided PVC Tubing, 16mm OD x 10mm ID	30	3-63 3.30	99.00	
	DN8-19 / Adaptor, DN8 Cap Nut – 3/8" Hose Tail, Grey PVC	4	22.00 20.00	80.00	
	Solvent Primer to suit Type "P" Cement	5	FREE	FREE	
	Solvent Cement, 500mL, Type "P" Clear	5	FREE	FREE	

COVERING THE WATERFRONT 50 YEARS

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Thank you.

Terms & Conditions
The above prices are:

1. Nett
2. Freight is FOB ex our Brisbane warehouse or as stated above.
3. **Excludes 10% GST unless shown above. Ionics ABN is 17 080 174 009.**
4. Quote is valid for 60 days from the date of this quotation.

Account customers: Payment of the goods & services nominated in this quotation will be due 30 days from the end of the month of invoicing.
Please note that clear title of any goods ordered and purchased will not pass from Ionics Watertec Pty Ltd to any third party until payment has been received in full.

Cash sales: Payment must be received before goods will be dispatched.

Please use quote number when ordering goods.

We trust this is sufficient to enable an evaluation of our offer. If however, additional information or a more detailed proposal is required, do not hesitate to contact our office.

Regards,
Ionics Australasia Pty. Ltd.

Phill Haegens
National Sale - Water Systems

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Thank you.

L/Sc for 10 minutes)

C7: chtXLevLoLo
C8: chtXroc30PcntAlm

3.9 Chemical Tanks Dosing Pump Alarms

3.9.1 Functional Description

The Dosing pump alarms will be set high whenever the power available input is off or the pump fault input is active. These alarms will be reset using the remote reset button when the selector switch is in remote or using the local reset button (not via the RTU) when the selector switch is in any position.

3.9.2 Calculation Algorithm

The following algorithm will describe the availability status :

```
S0: chtXDospmpFault = 0;
S1: chtXDospmpFault = 1;

S0: if (not C1) or C2  or C10                then PS = S1
S1: if (C1 and (not C2) and (not C10) and C6 and C4) or
       (C1 and (not C2) and (not C10) and C5)    then PS=S0

If  (C7 and C9 and (not C8)) then chtXpmpFailToRun = 1
                             else chtXpmpFailToRun = 0

If  (C1 and (not C2) and C6 and C4) then
                             Pulse DosPmpsFltReset DO
```

The conditions for the state transitions defined above are as follows:

C1: chtXDosPmpCtlPwAv_DI
C2: chtXDosPmpFlt_DI
C3: DosPmpsFltReset
C4: DosPmpsRemoteReset
C5: DosingSystemSwLocalDI
C6: DosingSystemSwRemoteDI
C7: chtXDosPmpRunEnable
C8: chtXDosPmpRunStatus_DI

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C9: chtX_30sDosPmpStTim expired
C10:chtXpmpFailToRun

3.10 Chemical Tanks Dosing Start/Stop Control

3.10.1 Functional Description

The Dosing System start/stop control will be performed as per the following sequence.

3.10.2 Calculation Algorithm

The following algorithm will describe the start/stop sequence :

```
S0: Chemical Dosing Stopped
    cht1DosPmpRunEnable = 0
    cht2DosPmpRunEnable = 0
    DosPmpsSpeedHiEnable = 0
    DosPmpsSpeedLoEnable = 0
    cht1OutVlvOpenEnable = 0
    cht1OutVlvCloseEnable = 1
    cht2OutVlvOpenEnable = 0
    cht2OutVlvCloseEnable = 1
    chtDosSysOperating = 0
    pulse chtRemDosStop = 0

S1: Chemical Dosing Open Hypo Valve
    cht1DosPmpRunEnable = 0
    cht2DosPmpRunEnable = 0
    DosPmpsSpeedHiEnable = 0
    DosPmpsSpeedLoEnable = 0
    cht1OutVlvOpenEnable = 1
    cht1OutVlvCloseEnable = 0
    cht2OutVlvOpenEnable = 0
    cht2OutVlvCloseEnable = 1
    chtDosSysOperating = 0

S2: Chemical Dosing Start Hypo Pump
    cht1DosPmpRunEnable = 1
    cht2DosPmpRunEnable = 0
    DosPmpsSpeedHiEnable = 0
    DosPmpsSpeedLoEnable = 1
```

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```
        cht1OutVlvOpenEnable = 1
        cht1OutVlvCloseEnable = 0
        cht2OutVlvOpenEnable = 0
        cht2OutVlvCloseEnable = 1
        chtDosSysOperating = 0

    S3: Chemical Dosing Open Ammonium Tank
        cht1DosPmpRunEnable = 1
        cht2DosPmpRunEnable = 0
        DosPmpsSpeedHiEnable = 0
        DosPmpsSpeedLoEnable = 1
        cht1OutVlvOpenEnable = 1
        cht1OutVlvCloseEnable = 0
        cht2OutVlvOpenEnable = 1
        cht2OutVlvCloseEnable = 0
        chtDosSysOperating = 0

    S4: Chemical Dosing Start Ammonium Pump
        cht1DosPmpRunEnable = 1
        cht2DosPmpRunEnable = 1
        DosPmpsSpeedHiEnable = 0
        DosPmpsSpeedLoEnable = 1
        cht1OutVlvOpenEnable = 1
        cht1OutVlvCloseEnable = 0
        cht2OutVlvOpenEnable = 1
        cht2OutVlvCloseEnable = 0
        chtDosSysOperating = 0

    S5: Chemical Dosing Start Ammonium Pump
        cht1DosPmpRunEnable = 1
        cht2DosPmpRunEnable = 1
        cht1OutVlvOpenEnable = 1
        cht1OutVlvCloseEnable = 0
        cht2OutVlvOpenEnable = 1
        cht2OutVlvCloseEnable = 0
        chtDosSysOperating = 1


    S0: if (C1 or C5) and C4 and C11 and (not C12)  then PS=S1
    S1: if ((C2 or C6) and C4) or C12 or C3 or (not C11)or
        not(C3 or C4)
                        then PS=S0
        if (C7)         then PS=S2
    S2: if ((C2 or C6) and C4) or C12 or C3 or (not C11) or
        not(C3 or C4)
```

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```
                    then PS=S0
    if (C13)        then PS=S3
S3: if ((C2 or C6) and C4) or C12 or C3 or (not C11) or
    not(C3 or C4)
                    then PS=S0
    if (C9)         then PS=S4
S4: if ((C2 or C6) and C4) or C12 or C3 or (not C11) or
    not(C3 or C4)
                    then PS=S0
    if (C14)        then PS=S5
S5: if ((C2 or C6) and C4) or C12 or C3 or (not C11) or
    not(C3 or C4)
                    then PS=S0


C1: chtRemDosStart          (Chemical Dosing Remote Start)
C2: chtRemDosStop           (Chemical Dosing Remote Stop)
C3: DosingSystemSwLocalDI   (Dosing System Switch Local)
C4: DosingSystemSwRemoteDI  (Dosing System Switch Remote)
C5: DosingSystemRemStartTestDI   (Dos Sys Test Start)
C6: DosingSystemRemStopTestDI    (Dos Sys Test Stop)
C7: cht1OutVlvFO_DI         (Cht1 outlet valve Full Open)
C8: cht1OutVlvFC_DI         (Cht1 outlet valve Full Closed)
C9: cht2OutVlvFO_DI         (Cht2 outlet valve Full Open)
C10:cht2OutVlvFC_DI         (Cht2 outlet valve Full Closed)
C11:chtRemoteAv             (Cht remote available WSSOCR)
C12:DosingSysShutdown       (Dosing system shutdown flag)
C13:cht1_30sDosPmpStTim     (cht1 dosing pump start timer)
C14:cht2_30sDosPmpStTim     (cht2 dosing pump start timer)
```

3.11 Chemical Tanks Miscellaneous Alarms

3.11.1 Functional Description

The Chemical Dosing System contains a number of miscellaneous alarms as follows.

A temperature high alarm will be generated when the temperature high digital input is active. This input will not be reset until the Temperature High digital input has been reset for a minimum of 5 minutes or the Remote Reset is pressed from WSSOCR or the local reset is pressed at Hay St (assuming we wire it in).

The Chemical Dosing Room door switch will activate an

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intruder alarm at WSSOCR. When activated this alarm will not reset until the Door switch has been activated (door closed) for a period of 15 minutes.

The control panel LEDs will be controlled via the Lamp Test Switch digital input. When this input is in the Test position the LEDs will flash at 2 second intervals with only half being on at any point in time. When this switch is in the Off position no LEDs will work. When this switch is in the Not Off and Not Test position then the LEDs will be controlled as per normal from the Isagraf Logic (assuming this is a three position switch?).

3.11.2 Calculation Algorithm

The following algorithm will describe the Temperature High Alarm sequence :

S0: Temeprature High Alarm inactive
S1: Temperature High Alarm active

If (C1) then Next State : S1
If ((not C1) and C2)or((not C1) and C3)
then Next State : S0

The following algorithm will describe the Chemical Dosing Room Door Switch Alarm sequence :

S0: Intruder Alarm inactive
S1: Intruder Alarm active

If (not C5) then Next State : S1
If ((not C5) and C6)or((not C1) and C3)
then Next State : S0

The following algorithm will describe the Chemical Dosing Control Panel Alarm sequence :

S0: LED Off Mode active
S1: LED Test Mode active
S2: LED Normal Mode active

If (not C5) then Next State : S1
If ((not C5) and C6)or((not C1) and C3)

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```
                    then Next State : S0


        C1: chtTempHialarm          (DI active)
        C2: xxx1dly expired         (Local Timer expired - 5 Min)
        C3: chtRemoteReset          (Remote Reset)
        C4: chtBuildDoorSw          (Bulding Door Limit Sw)
        C5: xxx2dly expired         (Local Timer expired - 15 Min)
        C6: chtLampTstSwOff         (Off Selected on Lamp Test Sw
                                    DI)
        C7: chtLampTstSwTest        (Test Selected on Lamp Test
                                    Switch DI)
        C8: cht
```

3.12 ISAGRAF I/O VARIABLES

External Digitals Inputs

```
ChtTempHiAlarm
chtLampTstSwOff
chtLampTstSwTest
chtSysSwLocalDI
chtSysSwRemoteDI
chtSysReStTestDI
chtSysReSpTestDI
cht1OutVlvOpenPB
cht1OutVlvClosPB
cht2OutVlvOpenPB
cht2OutVlvClosPB
cht1DosPmpPower
cht1DosPmpRun
cht1DosPmpFault
cht2DosPmpPower
cht2DosPmpRun
cht2DosPmpFault
cht1OutVlvFO
cht1OutVlvFC
cht1BundLevHigh
cht2OutVlvFO
cht2OutVlvFC
cht2BundLevHigh
chtBuildDoorSw
```

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External Digitals Outputs

cht1PressLowLED
cht2PressLowLED
cht1OutVOpenLED
cht1OutVCloseLED
cht1OutVFaultLED
cht2OutVOpenLED
cht2OutVCloseLED
cht2OutVFaultLED
cht1DosPmpAvLED
cht1DosPmpRunLED
cht1DosPmpFltLED
cht2DosPmpAvLED
cht2DosPmpRunLED
cht2DosPmpFltLED
cht1DosPmpRunEn
cht2DosPmpRunEn
chtPmpSpeedHiEn
chtPmpSpeedLoEn
chtPmpFltResetEn
cht1OutVlvOpenEn
cht1OutVlvClosEn
cht2OutVlvOpenEn
cht2OutVlvClosEn
chtTankFullAudEn
cht1LevelLowLED
cht2LevelLowLED

Internal Digitals

chtDosRateLow
chtDosRateHi
cht1lowAlarm
cht1lowlowAlarm
cht2lowAlarm
cht2lowlowAlarm
cht1highAlarm
cht2highAlarm
chtXroc30PcntAlm
valXctrlFailed
preXlowAlarm
preXHighAlarm

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chtXlevelInvalid
chtXpreInvalid
chtXDosPmpFault
chtRemDosStart
chtDosSysOperating
chtXpmpFailToRun
chtRemoteReset

External Analogs

cht1levelAI
cht2levelAI
cht1PmpDischPrAI
cht2PmpDischPrAI

Internal analogs

cht1LevLowLimit
cht2LevLowLimit
cht1LevLoLoLimit
cht2LevLoLoLimit
cht1LevHighLimit
cht2LevHighLimit
cht1LevRateOfDropHiLm
cht2LevRateOfDropHiLm
cht1PreLowLimit
cht2PreLowLimit
cht1PreHighLimit
cht2PreHighLimit
cht1RangeLevelOne
chtHighDosLm
chtLowDosLm
cht1roc0PumpsLim
cht1rocLowSpeLim
cht1rocHiSpeLim
cht1rocMaxLim
cht2roc0PumpsLim
cht2rocLowSpeLim
cht2rocHiSpeLim
cht2rocMaxLim
cht1roc05PcntDef
cht1roc10PcntDef
cht1roc20PcntDef

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```
cht1roc30PcntDef
cht2roc05PcntDef
cht2roc10PcntDef
cht2roc20PcntDef
cht2roc30PcntDef
```

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Appendix 3

Tanker Driver Check Sheets - Refilling the Two Storage Tanks

APPENDIX 3 - PART A

REFILLING AMMONIA SULPHATE TANK

Cautions

1. During filling of tank, personal protective clothing and face shield must be worn.
2. Avoid eye and skin contact and avoid vapour inhalation.
3. If any spillage of chemical is leaked into sump pit, it must be tankered away and not released into the creek.

Procedural Steps

1. Before any transfer of chemical, ensure sump valve painted white outside building, is closed to isolate sump from creek.
2. Turn on the ventilation fans. (Switches located under light switch.)
3. Flush safety shower for five minutes.
4. Use all personal protective equipment. Eg. Full face shield, pvc/rubber gloves, raincoat, rubber boots.
5. Check for excess solution in filling pipework by opening ball valve 14B. (Located under screw adaptor), then close valve 14B.
6. Remove screwed cap.
7. Connect filler hose.
8. Open ball valve 15B (above screw adaptor).
9. Fill the tank until the solution reaches the top of the sight glass.
10. When the solution has reached the top of the sight glass, stop filling and close valve 15B.
11. Drain the excess solution by opening ball valve 14B to drain the solution at the screw adaptor, then close ball valve 14B when solution has drained. (Do not leave the solution in the bucket on site.)
12. Remove filler hose and replace screwed cover.
13. If any spillage of chemical is leaked into sump pit, it must be tankered away and not released into the creek.
14. Ensure sump valve outside building has been left open when transfer of chemical has been completed.

APPENDIX 3 - PART B

REFILLING SODIUM HYPOCHLORIDE TANK

Cautions

1. During filling of tank, personal protective clothing and face shield must be worn.
2. Sodium Hypochloride is highly irritating, corrosive and toxic. Avoid eye and skin contact and vapour inhalation.
3. If any spillage of chemical is leaked into sump pit, it must be tankered away and not released into the creek.

Procedural Steps

1. Before any transfer of chemical, ensure sump valve painted white outside building, is closed to isolate sump from creek.
2. Turn on the ventilation fans. (Switches located under light switch.)
3. Flush safety shower for five minutes.
4. Use all personal protective equipment. Eg. Full face shield, pvc/rubber gloves, coveralls, pvc apron, rubber boots.
5. Check for excess solution in filling pipework by opening ball valve A1. (Under camlock), then close valve A1.
6. Remove camlock cover.
7. Connect filler hose.
8. Open ball valve A2 (above camlock).
9. Fill the tank until the solution reaches the top of the sight glass.
10. When the solution has reached the top of the sight glass, stop filling and close valve A2.
11. Drain the excess solution by opening ball valve A1. Then close ball valve A1 when solution has drained. (Do not leave the solution on site.)
12. Remove filler hose and replace camlock cover.
13. If any spillage of chemical is leaked into sump pit, it must be tankered away and not released into the creek.
14. Ensure sump valve outside building has been left open when transfer of chemical has been completed.

Appendix 4

Manual Startup Procedures

APPENDIX 4 - PART A

START UP PROCEDURE for SODIUM HYPOCHLORIDE SYSTEM

Procedural Steps

1. Ensure emergency stop button is out.
2. Main switch is on.
3. Chlorination switch is set to local.
4. Hypo switch is on.
5. Close valve A16 on bleeder line.
6. Open 3-way valve on Sodium Hypochloride suction line.
7. Turn speed pot controller to desired speed. (Between 1 and 10.)
8. To return dosing pumps to remote:-
   - i. Close 3-way valve.
   - ii. Open valve A16 on bleeder line.
   - iii. Return speed pot controller to zero.
   - iv. Leave hypo switch on.
   - v. Chlorination switch to remote.
   - vi. Main switch is on.
   - vii. Emergency stop button is out.

APPENDIX 4 - PART B

START UP PROCEDURE for AMMONIA SULPHATE SYSTEM

Procedural Steps (Note: sodium hypochloride solution to be set up first)

1. Ensure emergency stop button is out.
2. Main switch is on.
3. Chlorination switch is set to local.
4. Ammonia switch is on.
5. Open 3-way valve on Ammonia Sulphate suction line.
6. Ensure delivery pipework ball valves B5, B6, B8 and B11 are open.
7. Turn speed pot controller to desired speed. (Between 1 and 10.)
8. To return dosing pumps to remote:-
   - i. Close 3-way valve.
   - ii. Return speed pot controller to zero.
   - iii. Leave ammonia switch on.
   - iv. Chlorination switch to remote.
   - v. Main switch is on.
   - vi. Emergency stop button is out.

Appendix 5

System Alarms

APPENDIX 5

Alarm System

Hay St Chemical Dosing Tank Database modifications

Tag Name	Description	Design	mod_add Hex	Slot	Channel # 1 - 16
cht1HighAlarm	Sodium Hypo tank high Alarm - derived	1	82	130	8
cht1levelInvalid	Sodium Hypo Tank level invalid	1	82	130	9
cht1lowAlarm	Sodium Hypo tank low Alarm - derived	1	85	133	8
cht1lowlowAlarm	Sodium Hypo tank low low Alarm - derived	1	83	131	10
cht1rocNoPmpsAlm	Sodium Hypo Tank Rate of Change No Pumps Alarm	1	82	130	12
cht1rocLoSpeAlm	Sodium Hypo Tank Rate of Change Low Speed Alarm	1	83	131	11
cht1rocHiSpeAlm	Sodium Hypo Tank Rate of Change High Speed Alarm	1	82	130	11
cht1blockage	Sodium Hypo Tank blockage alarm	1	85	133	10
cht1prehighAlarm	Sodium Hypo tank Pressure high Alarm - derived	1	84	132	7
cht1PressInvalid	Sodium Hypo Tank Pressure Invalid	1	84	132	9
cht1prelowAlarm	Sodium Hypo tank Pressure low Alarm - derived	1	84	132	8
cht1vlvctrlFail	Sodium Hypo tank Outlet Valve Control Failed	1	84	132	14
cht1vlvAvRem	Sodium Hypo tank Outlet Valve Available Remote	1	84	132	13
cht2highAlarm	Ammonium Sulphate tank high Alarm - derived	2	82	130	13
cht2levelInvalid	Ammonium Sulphate Level Invalid	2	82	130	16
cht2lowAlarm	Ammonium Sulphate tank low Alarm - derived	2	85	133	9
cht2lowlowAlarm	Ammonium Sulphate tank low low Alarm - derived	2	83	131	14
cht2rocNoPmpsAlm	Ammonium Sulphate Tank Rate of Change No Pumps Al	2	83	131	3
cht2rocLoSpeAlm	Ammonium Sulphate Tank Rate of Change Low Speed A	2	83	131	15
cht2rocHiSpeAlm	Ammonium Sulphate Tank Rate of Change High Speed	2	83	131	2
cht2blockage	Ammonium Sulphate Tank blockage alarm	2	85	133	11
cht2prehighAlarm	Ammonium Sulphate tank Pressure high Alarm - derived	2	84	132	10
cht2PressInvalid	Ammonium Sulphate Pressure Invalid	2	84	132	12
cht2prelowAlarm	Ammonium Sulphate tank Pressure low Alarm - derived	2	84	132	11
cht2vlvctrlFail	Ammonium Sulphate Tank Outlet Valve Control Failed	2	84	132	16
cht2vlvAvRem	Ammonium Sulphate tank Outlet Valve Available Remote	2	84	132	15
cht1DosPmpRunEn	Sodium Hypo Dosing Pump Run Enable	1	21	8	15
cht2DosPmpRunEn	Ammonium Sulphate Dosing Pump Run Enable	2	21	8	16
chtPmpSpeedHiEn	Chemical Dosing Pumps Speed High Enable	1	22	9	1
chtPmpSpeedLowEn	Chemical Dosing Pumps Speed Low Enable	1	22	9	2
cht1OutVlvOpClEn	Sodium Hypo Outlet Valve Open Enable	1	22	9	4
cht2OutVlvOpClEn	Ammonium Sulphate Outlet Valve Open/Close Enable	2	22	9	6
chtRemote	Chemical Dosing In Remote	1	84	132	1
chtLocal	Chemical Dosing In Local	1	84	132	2
chtOff	Chemical Dosing In Off	1	84	132	3
chtTestMode	Chemical Dosing In Test Mode	1	84	132	4
chtDosSysOperate	Chemical Dosing System Operating	1	84	132	6
chtDosSysShutdwn	Chemical Dosing System Shutdown	1	84	132	5
chtDosRateLow	Chemical Dosing System Dose Rate Low	1	85	133	2
chtDosRateHigh	Chemical Dosing System Dose Rate High	1	85	133	1
cht1PmpFailtoRun	Chemical Dosing Pump 1 Fail to Run	1	85	133	3
cht2PmpFailtoRun	Chemical Dosing Pump 2 Fail to Run	2	85	133	4
chtTempHiAlarm	Chemical Dosing Temperature High Alarm DI	1	12	4	1
chtLampTstSwOff	Chemical Dosing Lamp Test Switch Off Selected DI	1	12	4	2
chtLampTstSwTest	Chemical Dosing Lamp Test Switch Test Selected DI	1	12	4	3
chtSysSwLocalDI	Dosing System Selector Switch Local DI	1	12	4	4
chtSysSwRemoteDI	Dosing System Selector Switch Remote DI	1	12	4	5
chtSysReStTestDI	Dosing System Remote Start Test Switch DI	1	12	4	6
chtSysReSpTestDI	Dosing System Remote Stop Test Switch DI	1	12	4	7
cht1DosPmpPower	Sodium Hypo Dosing Pump Control Power Available DI	1	12	4	12
cht1DosPmpRun	Sodium Hypo Dosing Pump Running DI	1	12	4	13
cht1DosPmpFault	Sodium Hypo Dosing Pump Fault DI	1	12	4	14
cht2DosPmpPower	Ammonium Sulphate Dosing Pump Control Power Availa	2	12	4	15
cht2DosPmpRun	Ammonium Sulphate Dosing Pump Running DI	2	12	4	16
cht2DosPmpFault	Ammonium Sulphate Dosing Pump Fault DI	2	13	5	1
cht1OutVlvFO	Sodium Hypo Storage Tank Out Vlv Fully Open DI	1	13	5	2
cht1OutVlvFC	Sodium Hypo Storage Tank Out Vlv Fully Closed DI	1	13	5	3
cht1BundLevHigh	Sodium Hypo Storage Tank Bund Level High DI	1	13	5	4
cht2OutVlvFO	Ammonium Sulphate Storage Tank Out Vlv Fully Open D	2	13	5	5
cht2OutVlvFC	Ammonium Sulphate Storage Tank Out Vlv Fully Closed	2	13	5	6
cht2BundLevHigh	Ammonium Sulphate Storage Tank Bund Level High DI	2	13	5	7
chtBuildDoorSw	Dosing Building Door Switch Closed DI	1	13	5	8
chtDosWSSOCRAv	Chemical Dosing System Remote Available WSSOCR	1	91	145	6
chtDosWSSOCRRes	Chemical Dosing System Remote Reset WSSOCR	1	91	145	7
cht1LevHighLimit	Sodium Hypo tank level high alarm limit	1	d7	215	5
cht1levelAI	Sodium Hypo Tank Level AI Ranged 0-1.2M. Displayed i	1	32	11	2
cht1LevLowLimit	Sodium Hypo tank level low alarm limit	1	d7	215	6
cht1LevLoLoLimit	Sodium Hypo tank level low low alarm limit	1	d8	216	1
cht1rocNoPumpLim	Sodium Hypo tank rate of change No Pumps Running Li	1	d8	216	6
cht1rocLowSpeLim	Sodium Hypo tank rate of change Low Speed Dosing Lim	1	d8	216	2
cht1rocHiSpeLim	Sodium Hypo tank rate of change High Speed Dosing Li	1	d8	216	3
cht2LevHighLimit	Ammonium Sulphate tank level high alarm limit	2	d7	215	7
cht2levelAI	Ammonium Sulphate Tank Level AI Ranged 0-1.2M. Disl	2	32	11	4
cht2LevLowLimit	Ammonium Sulphate tank level low alarm limit	2	d7	215	8
cht2LevLoLoLimit	Ammonium Sulphate tank level low low alarm limit	2	d8	216	8
cht2rocNoPumpLim	Ammonium Sulphate tank rate of change No Pumps Run	2	d8	216	7
cht2rocLowSpeLim	Ammonium Sulphate tank rate of change Low Speed Dos	2	d8	216	4
cht2rocHiSpeLim	Ammonium Sulphate tank rate of change High Speed Do	2	d8	216	5
cht1PreLowLimit	Sodium Hypo Pump Discharge Pressure Low Limit	1	d9	217	3
cht2PreLowLimit	Ammonium Sulphate Pump Discharge Pressure Low Limi	2	d9	217	5
cht1PreHighLimit	Sodium Hypo Pump Discharge Pressure High Limit	1	d9	217	2
cht2PreHighLimit	Ammonium Sulphate Pump Discharge Pressure High Lim	2	d9	217	4
cht1PmpDischPrAI	Sodium Hypo Pump Discharge Pressure AI	1	32	11	1
cht2PmpDischPrAI	Ammonium Sulphate Pump Discharge Pressure AI	2	32	11	3
chtDosHighLimit	Chemical Dosing Rate High Limit	1	d9	217	6
chtDosLowLimit	Chemical Dosing Rate Low Limit	1	d9	217	7
cht1level	Sodium Hypo Tank Level	1	a1	161	6
cht1roc10Minute	Sodium Hypo tank rate of change 10 minute	1	a1	161	7
cht1roc30Minute	Sodium Hypo tank rate of change 30 minute	1	a2	162	5
cht1Pressure	Sodium Hypo Tank Pressure	1	a3	163	8
cht2level	Ammonium Sulphate Tank Level	2	a2	162	6
cht2roc10Minute	Ammonium Sulphate tank of change 10 minute	2	a2	162	7
cht2roc30Minute	Ammonium Sulphate tank rate of change 30 minute	2	a2	162	8
cht2Pressure	Ammonium Sulphate Tank Pressure	2	a4	164	2
cht1hoursRun	Chem Dosing pump,1,1,Hours_run	1	a3	163	7
cht2hoursRun	Chem Dosing pump,1,1,Hours_run	2	a4	164	1

Appendix 6

Dose Rate Calculations

APPENDIX 6 - PART A

AMMONIA SULPHATE DOSING CALIBRATION

Cautions

1. During calibration, personal protective clothing and face shield must be worn.
2. Avoid eye and skin contact and avoid vapour inhalation.
3. Ensure the door remains open, exhaust fans are operating and that the emergency shower/eye wash is accessible.

Procedural Steps

1. Shut valve B2. Open valve B1.
2. Remove calibration tube lid and fill to the desired level with potable water.
3. Ensure delivery pipework ball valves B5, B6, B8 and B11 are open.
4. Use the Ammonia Sulphate manual start-up procedure.
5. Observe dosing rate.
6. An electrician is required to adjust the variable speed drive until required dosing rate is achieved. (Do not touch stroke adjustment knob on side of pump.)
7. Open valve B2. Shut valve B1.
8. Return switches to Remote when complete.
9. Note pump dosing rate in log book.

APPENDIX 6 - PART B

SODIUM HYPOCHLORIDE DOSING CALIBRATION

Cautions

1. During calibration, personal protective clothing and face shield must be worn.
2. Sodium Hypochloride is highly irritating, corrosive and toxic. Avoid eye and skin contact and avoid vapour inhalation.

Procedural Steps

1. Shut valve A4. Open valve A3.
2. Remove calibration tube lid and fill to the desired level with potable water.
3. Ensure delivery pipework ball valves A7, A8, A10 and A13 are open.
4. Use the Sodium Hypochloride manual start-up procedure.
5. Observe dosing rate.
6. An electrician is required to adjust the variable speed drive until required dosing rate is achieved. (Do not touch stroke adjustment knob on side of pump.)
7. Open valve A4. Shut valve A3.
8. Return switches to Remote when complete.
9. Note pump dosing rate in log book.

APPENDIX 6 PART C

Hay St Water Pumping Station
Chemical Dosing System
Data Sheet

Sodium Hypochlorite Tank	Ammonium Sulphate Tank
Diameter : 1100mm +/- 3%	Diameter : 1100mm +/- 3%
Total Volume = 1500L	Total Volume = 1500L
Workable volume = 1140L Workable Level Range : 0 - 1.2M	Workable volume = 1140L Workable Level Range : 0 - 1.2M
Dosing Rate Hi Speed : 26.9 L/Hr Dosing Rate Low Speed :17.9 L/Hr	Dosing Rate Hi Speed : 21 L/Hr Dosing Rate Low Speed :14 L/Hr
Hi Level Alarm : 95% Low Level Alarm : 25% Low Low Level alarm : 5%	Hi Level Alarm : 95% Low Level Alarm : 25% Low Low Level alarm : 5%

NB The dosing system will shutdown when either of the two tanks Low Low level alarm is reached. The dosing system will still operate if a High or Low level alarm is active on either tank.

In the interim all **shutdown** alarms have been OR-ed into a single alarm point called "Chemical Tank Mains Fail Alarm" on the MITS database. If this alarm is active then it could be anything from a Level Low Low Alarm to Bund Level High Alarm. In order in the interim to determine which alarm is active at any given time (providing it does not appear on the LEDs in the chemical dosing switchboard) you will have to access the Isagraf code online.

Cross-Sectional Area = PI * R^2 = 3.14157 * 1.1 * 1.1 / 4 = 0.95 m^2
Effective tank volume assuming 0.06 – 1.2M level range = 0.95 * 1.14 * 1000 L = 1083 L

Assuming a run time on low speed dosing of 6 hours per day we calculate the following figures:

At a level of 10% the Sodium Hypo will have 57L remaining and last for (57 / 17.9 / 6) 0.5 days.
At a level of 15% the Sodium Hypo will have 114L remaining and last for (114/ 17.9 / 6) 1.1 days.
At a level of 20% the Sodium Hypo will have 171L remaining and last for (171/ 17.9 / 6) 1.6 days.
At a level of 25% the Sodium Hypo will have 228L remaining and last for (228/ 17.9 / 6) 2.1 days.
At a level of 100% the Sodium Hypo will have 1083L remaining and last for (1083/ 17.9 / 6) 10.1 days.

At a level of 10% the Ammon Sulph will have 57L remaining and last for (57 / 14 / 6) 0.7 days.
At a level of 15% the Ammon Sulph will have 114L remaining and last for (114 / 14 / 6) 1.4 days.
At a level of 20% the Ammon Sulph will have 171L remaining and last for (171 / 14 / 6) 2.0 days.
At a level of 25% the Ammon Sulph will have 228L remaining and last for (228 / 14 / 6) 2.7 days.
At a level of 100% the Ammon Sulph will have 1083L remaining and last for (1083 / 14 / 6) 12.9 days.

The Sodium Hypo Pump Discharge Hi Pressure Alarm will be 95%
The Sodium Hypo Pump Discharge Low Pressure Alarm will be 55%

The Ammonium Sulphate Pump Discharge High Pressure Alarm will be 55%
The Ammonium Sulphate Pump Discharge Low Pressure Alarm will be 30%

APPENDIX 6 PART C

Rate of change alarms :
When no pumps are running the rate of change alarm will be set to 1 per cent
At a dosing rate of 17.9 L/Hr the rate of change in the level will be (17.9 / 950) 0.0188 M / Hr = 1.6% / Hr
At a dosing rate of 26.9 L/Hr the rate of change in the level will be (26.9 / 950) 0.0283 M / Hr = 2.4% / Hr
At a dosing rate of 14.0 L/Hr the rate of change in the level will be (14.0 / 950) 0.0147 M / Hr = 1.2% / Hr
At a dosing rate of 21.0 L/Hr the rate of change in the level will be (21.0 / 950) 0.0221 M / Hr = 1.8% / Hr

In summary

Sodium Hypochlorite Rate of change no pumps running 1% / Hr Alarm
Sodium Hypochlorite Rate of change low speed pumps running 2% / Hr Alarm
Sodium Hypochlorite Rate of change high speed pumps running 3% / Hr Alarm
Ammonium Sulphate Rate of change no pumps running 1% / Hr Alarm
Ammonium Sulphate Rate of change low speed pumps running 1.5% / Hr Alarm
Ammonium Sulphate Rate of change high speed pumps running 2.5% / Hr Alarm

The variable frequency drive settings are as follows:

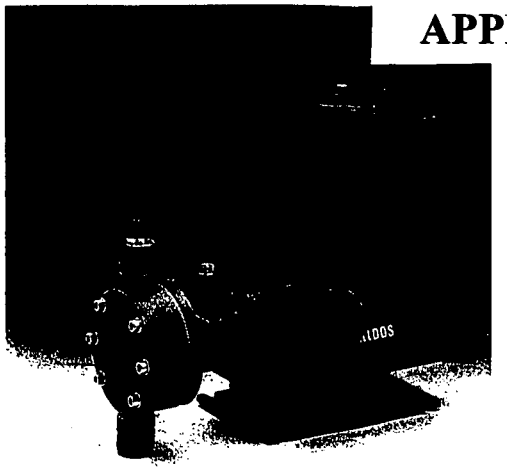
	Sodium Hypo Pump	Ammonium Sulphate Pump
Stroke of pump	90%	55%
Low Speed	81 Hz	80 Hz
High Speed	117 Hz	115 Hz

Appendix 7

Technical Information on the Piston Diaphragm Pumps and Equipment

APPENDIX 7

ALLDOS Dosing equipment



Technical Information
Piston Diaphragm
Dosing Pumps KM 251/252

General technical data	
Stroke volume	3,5 cm³
Accuracy	±1%
Suction height	1 m water gauge
Adjustment	manually; option: electrically or pneumatically
Materials	dosing head and valves see Parts List; dosing diaphragm: PTFE
Drive	standard versions: three-phase motor 220-240 / 380-415 V, 50/60 Hz, 0,06 kW (up to 16 bar) and 0,09 kW (25 bar), IP 54, ins. cl. B other motors: see Parts List
Connections	DN 8 for: PVC-hose 6/12 or PVC-tube 12 x 1,1 PP-tube 16 x 1,5 PVDF-tube 16 x 1,5 steel-tube R 1/4" Hastelloy C-tube R 1/4"
Colour	RAL 6017
Weight	single pump: 8 - 9.5 kg; double pump: 11 - 12 kg

Performance data

Order numbers		50 Hz			60 Hz				
Single pump	Double pump	l/h*	bar	n/min	l/h*	USg/h*	bar	psi	n/min
251-5	251-5/2	5	10	29	6	1.6	10	145	35
251-13	251-13/2	13	10	63	16	4.2	10	145	75
251-19	251-19/2	19	10	96	23	6	10	145	115
251-24	251-24/2	24	10	120	-	-	-	-	-
251-4.9	251-4.9/2	4.9	16	29	5.9	1.6	16	232	35
251-12	251-12/2	12	16	63	14	3.7	16	232	75
251-18	251-18/2	18	16	96	22	5.8	16	232	115
251-23	251-23/2	23	16	120	-	-	-	-	-
251-4.5	251-4.5/2	4.5	25	29	5.4	1.4	25	362	35
251-11	251-11/2	11	25	63	13	3.4	25	362	75
251-17	251-17/2	17	25	96	20	5.3	25	362	115
251-21	251-21/2	21	25	120	-	-	-	-	-

** l/h and USg/h per dosing head. Please double the capacity for double pumps.*

Operation

The KM 251/252 are reciprocating dosing pumps with hydraulic diaphragm drive. The operation is explained on the sectional drawing:

The rotation of the motor (1) is transformed via the worm gear (7) and eccentric (57) into the oscillating suction and stroke movement of the piston (14). The piston is hollow and has a range of radial drilled control holes, providing a hydraulic connection between the drive piston and the oil reservoir.

The control slide (15) covers the drilled holes during the stroke and isolates the stroke compartment from the drive compartment. An equivalent volume of dosing medium is displaced from the dosing head (21) into the dosing line via the hydraulic displacement of the teflon diaphragm (20). During the suction stroke the piston produces a vacuum, which is duplicated in the dosing head; this closes the pressure valve (51), and the medium flows through the suction valve (52) into the dosing head.

The size of the stroke volume is determined by the position of the control slide. The active stroke length, and thus the pump output can be adjusted continuously and linearly from 0 to 100% by the stroke control knob (31) with vernier scale.

The overpressure valve (25)

opens, if a too high pressure occurs in the pump discharge, protecting the pump and the dosing line from overpressure.

The diaphragm protection system AMS (19)

has a contact zone touching the dosing diaphragm (20). The diaphragm is free-swinging in the dosing head. It cannot be overstretched by closed suction or delivery conditions, as the diaphragm protection valve closes in such a case, closing the hydraulic drive circuit and relieving pressure on the diaphragm.

Installation

The dosing pump is fixed with 4 M8-screws on the pump support bracket or on the prepared pump basis. The following should be observed for the installation of the pump and pipework:

- Suction height max. 1 m water gauge for media not evolving gas, and media with a viscosity similar to water.

1.5/251-00/07.91E

APPENDIX 7

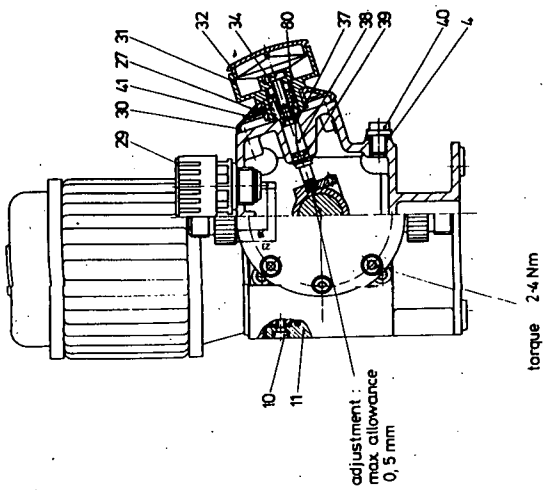
Item	Part No.	Description		Material	Remarks
37	52.122	O-ring 7 x 1.5		Perbunan	
38	10.4851-400	Adjusting spindle			KM 251
38	10.5591-400	Adjusting spindle			KM 252
39	50.540	Safety ring 10 x 1		Spring steel	DIN 471
40	50.991	Closing screw R 1/8"		Galvan. steel	DIN 908
41	10.4849-400	Graduated ring			
42	10.3763-201	Piston flange		Grey cast iron	KM 251
42	10.3763-202	Piston flange		Grey cast iron	KM 252
43	10.6293-400	Adjusting screw		9 S 20 K	
44	50.1219	Cylindrical screw M 4 x 8		1.4541	DIN 912
45	50.1109	Ring gasket 4.2 x 8 x 1		Copper	
48	533-300-	Gear oil, cpl., 1.5 l			Single or double pump
49	51.519	Lateral disc 12.5 x 19 x 0.5 SNSH			
50	10.334-4	Worm wheel	120 Strokes/min (50 Hz)	HG	for KM 251, 252: 10, 16 bar
	10.335-4	Worm wheel	120 Strokes/min (50 Hz)	Bronze	for KM 251: 25 bar
	10.2649-4	Worm wheel	96 Strokes/min (50 Hz)	Bronze	for KM 251, 252: 10 - 25 bar
	10.331-4	Worm wheel	63 Strokes/min (50 Hz)	HG	for KM 251, 252: 10, 16 bar
	10.332-4	Worm wheel	63 Strokes/min (50 Hz)	Bronze	for KM 251: 25 bar
	10.333-4	Worm wheel	29 Strokes/min (50 Hz)	HG	for KM 251, 252: 10, 16 bar
	10.329-4	Worm wheel	29 Strokes/min (50 Hz)	Bronze	for KM 251: 25 bar
	10.2243-4	Worm wheel	29 Strokes/min (100 Hz)	Bronze	for KM 251, 252: 10 - 25 bar
51	10.788-41	Pressure valve DN 8		PVC	
	10.788-42	Pressure valve DN 8		1.4571	
	10.788-46	Pressure valve DN 8		Hastelloy C	
	10.788-48	Pressure valve DN 8		PP	
	10.788-47	Pressure valve DN 8		PVDF	
52	10.788-41	Suction valve DN 8		PVC	
	10.788-42	Suction valve DN 8		1.4571	
	10.788-46	Suction valve DN 8		Hastelloy C	
	10.788-48	Suction valve DN 8		PP	
	10.788-47	Suction valve DN 8		PVDF	
53	52.105-2	O-ring 13 x 2.5		Viton B	
54	51.508	Lateral disc 30.5 x 40 x 0.5			
55	51.504	Needle bearing 30 x 40 x 17 RNAF			
56	50.506	Safety ring 30 x 1.5		Spring steel	DIN 471
57	10.341-4	Eccentric			
58	51.501	Deep groove ball bearing 12 x 32 x 10, 6201 RS			for KM 251-252, 10 bar
	51.527	Deep groove ball bearing 12 x 32 x 10, 6201 RS			for KM 251, 16-25 bar
60	10.1763-41	Valve seat		1.4571	for Steel-valve, 25 bar
	10.1763-42	Valve seat		Hastelloy C	for Hastelloy C-valve
	10.269-41	Valve seat		PTFE	for PVDF-valve
	10.269-42	Valve seat		Viton	for PVC-, steel valve, 10 bar
61	10.139	Ball Ø 8		Glass	for PVC valve
	10.1361	Ball Ø 8		1.4401	for Steel-valve
	10.3595	Ball Ø 8		Hastelloy C	for Hastelloy C - valve
	10.073	Ball Ø 8		PTFE	for PVDF valve
62	10.786-41	Ball cage		PVC	
	10.786-42	Ball cage		1.4571	
	10.786-403	Ball cage		Hastelloy C	
	10.786-404	Ball cage		PP	
	10.786-405	Ball cage		PVDF	
64	52.131	O-ring 9 x 1.5		Viton A	only for KM 251, 25 bar
65	52.212	O-ring 28 x 2.5		Perbunan	
67	50.248	Cylindrical screw M 5 x 16		Galvan. steel	DIN 912
68	50.036	Spiral pin 2.5 x 14		CK 67	DIN 7344
75	50.609	Spiral pin 3 x 24		CK 67	DIN 7344
80	50.1292	Fitting disk 10 x 16 x 1		Steel	DIN 988

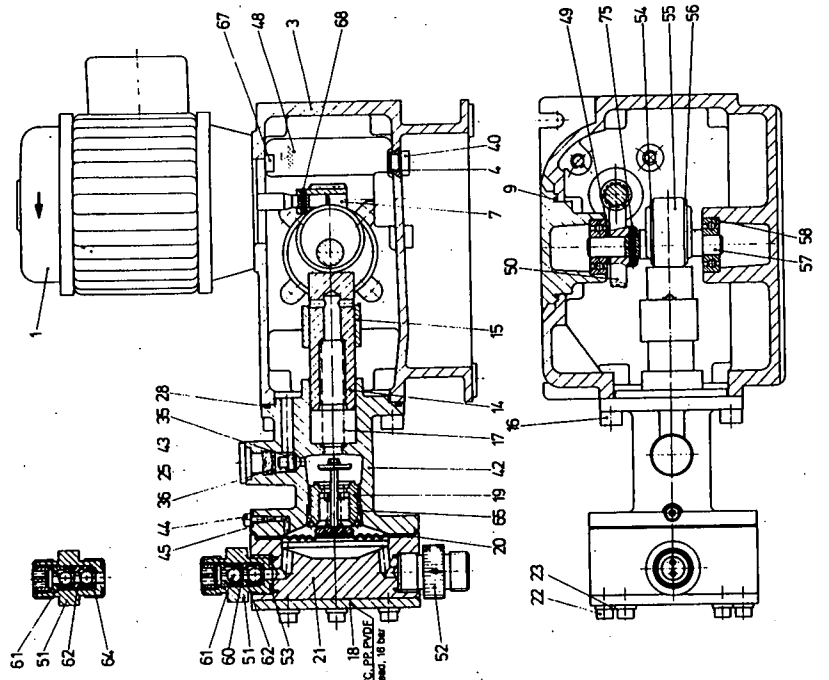
Spare parts set, composed of: dosing diaphragm, inner valve parts, 1 set of O-rings and gaskets.
For a double pump, please order twice the spare parts set.

553-251	for KM 251	1.4571-Design, 25 bar
553-253	for KM 251	PVC-Design
553-254	for KM 251	1.4571-Design, 10 and 16 bar
553-257	for KM 251	PVDF-Design
553-258	for KM 252	PVC-Design
553-259	for KM 252	1.4571-Design
553-262	for KM 252	PVDF-Design

Repeated call in PE-container

553-300	for KM 251 - KM 252, 1.5 litres	





Item	Part No.	Description	Material	Remarks
1.	45.189	Motor 0.06 kW, 220-240/380-415 V, IP 54/6 4P		KM 251 (10-16) bar Single pump
	45.021	Motor 0 - 0.09 kW, 220-240/380-415 V, IP 54/6 4P		KM 251 (25 bar) KM 252
3	10.4802-100	Housing		Single pump
	10.4807-100	Housing		Double pump
4	54.001	Flat gasket, 10.5 x 15 x 1.5	Klingerit	
7	10.335-4	Worm 120 strokes/min (50 Hz)		
	10.2649-4	Worm 96 strokes/min (50 Hz)		
	10.333-4	Worm 63 strokes/min (50 Hz)		
	10.330-4	Worm 29 strokes/min (50 Hz)		
	10.2244-4	Worm 29 strokes/min (100 Hz)		
9	52.120	O-ring 53 x 2	Perbunan	
10	50.409	Cyl. screw M 5 x 12, DIN 6912	Galvan. steel	DIN 6912
11	10.4804-300	Bearing cover		
14	10.5801-401	Piston		for KM 251
	10.5801-402			for KM 252
15	10.2041-41	Control side, complete	Brass	for KM 251
	10.2041-42	Control side, complete	Brass	for KM 252
16	50.907	Cyl. screw M 8 x 20	1.4571	DIN 912
17	10.5802-400	Piston spring		
18	10.5839-400	Disc	Steel	only for PVC, PVDF, 16 bar
19	10.5796-402	Diaphragm protecting valve, complete		
20	10.5805-400	Diaphragm	PTFE	
21	10.5803-303	Dosing head	PVC	
	10.5799-301	Dosing head	1.4571	
	10.5803-305	Dosing head	PP	
	10.5803-304	Dosing head	PVDF	
	10.5799-302	Dosing head	Hastelloy C	
22	50.915	Cyl. screw M 6 x 50	1.4301	DIN 912
	50.124	Cyl. screw M 6 x 60	1.4301	only for PVC, PVDF, 16 bar
23	50.452	Disc	1.4301	DIN 125
25	48.842-19.2	Valve cover	PE	
27	50.1234	Threaded pin M 3 x 8	1.4301	DIN 916
28	52.163	O-ring 75 x 2.7	Perbunan	
29	10.4852-402	Oil observation		
30	10.4845-400	Front plate		Single pump
	10.4971-300	Front plate		Double pump
31	10.4846-400	Stroke control knob		
32	10.4847-400	Cover of stroke control knob		
34	50.1225	Cyl. screw M 6 x 20	Galvan. steel	DIN 912
35	10.6335-400	Degassing valve, cpl.		
36	10.6335-400	Pressure spring		for 10 bar
	10.6336-400	Pressure spring		for 16 bar
	10.6337-400	Pressure spring		for 25 bar

APPENDIX 7

Safety Advice

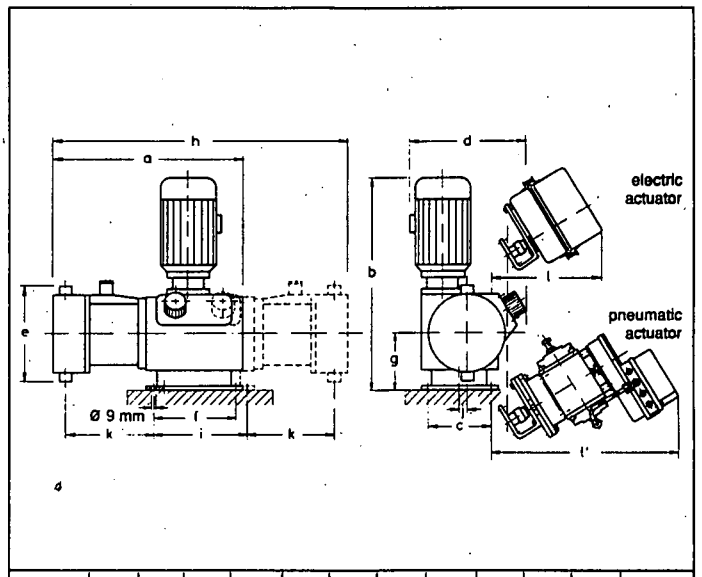
Ensure the wetted parts are suitable for the chemical, temperature and operating pressure. We are able to give you further information; please indicate the media you use, its temperature and the operating pressure.

When using chemicals, please observe the safety precautions of the manufacturer.

Guarantee

The guarantee is based on our General Conditions of Sales and Delivery. During the guarantee period, service work and modifications are done exclusively by our staff.

Variations require our permission, inorder that the guarantee is not invalidated.



a	b	c	d	e	f	g	h	i	j	k	l	l'
298	272	98	190	160	152	86	416	152	16	116	210	320

Measurements in mm
Technical data subject to change without notice

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APPENDIX 7

- Pumps for gas-evolving media and media with a high viscosity should be flooded suction (figure 1).
- Suction and pressure lines DN 8 are, according to the pump version, PVC-tube 12 x 1.1, PVC-hose 6 x 17, PVDF- tube 17 x 1.5 or steel tube R 1/4".
- Suction lines must be designed in a way, that cavitation is avoided. They should be kept as short as possible. In plants requiring long suction lines, adequate suction pulsation dampers should be installed directly before the pump (figure 2).
- The internal diameter of the lines, connecting parts and fittings should not be less than DN 8; swept bends should be used instead of elbows, if necessary (figure 3).
- Important hint: For the correct functioning of the dosing pump, a positive pressure difference of min. 20 m water gauge is necessary. If the sum of backpressure and static head between suction valve and dosing point is less than 20 m water gauge, a pressure retention valve must be installed directly before the dosing point (figure 1).

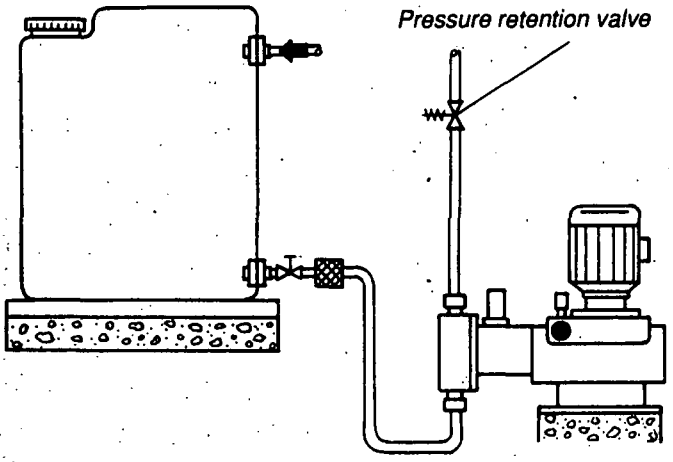

Figure 1

Electrical Connection

The motor (1) is connected according to the terminal connection diagram (stamped in the cover of the connection case), observing the local rules for electrical installations.

Observe the sense of rotation! A motor protection switch or a motor contactor with bimetal relay adjusted to the nominal motor current must be incorporated.

Initiation

The pump is tested in the works but the oil is removed for shipment. Before start-up, fill the supplied special oil into the pump as follows:

- Unscrew the oil deaeration screw (29).
- Turn the control knob (31) to 0, slowly fill the supplied hydraulic oil into the orifice of the screw (29), until the oil reaches the level of the mark at the oil measuring stick.
- Operate the pump for appr. 5 min. after deaerating the dosing head.
- Put the adjusting knob to 40%, loosen the degassing screw (44), until all the air has escaped, then re-tighten it..
- After appr. 10 min. switch off the pump. Check the oil level and fill in oil, if necessary.
- Fix the oil measuring stick.
- Note: the length of the oil measuring stick of KM 251/252 is 23 mm; depth of immersion until the mark appr. 5 mm.

For the first startup of plants, where the pump is not on flooded suction, the pressure valve (51) should be removed, and the dosing head should be filled with the dosing medium. When refitting the pressure valve, observe the direction sign.

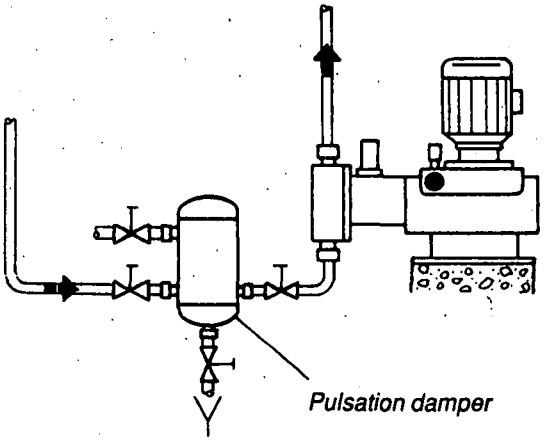

Figure 2

Stroke Adjustment

The zero-point (zero dosing) of the pump is adjusted in the works at a pressure of 1 bar. If the actual operating pressure is far above or below this value, re-adjustment of the zero-point leads to more exact dosing values. Re-zeroing is best achieved by a calibration pot on the pump suction, or alternatively drawing from a small measuring cylinder.

- Adjust the dosing flow to 15%.
- Switch on the dosing pump, and turn the adjusting knob slowly into the direction of 0, until the dosing observed in the calibration pot or measuring cylinder stops.

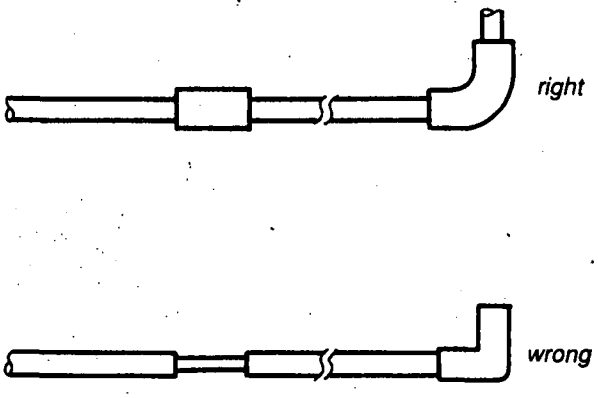

Figure 3

APPENDIX 7

direction of 0, until the dosing observed in the calibration pot or measuring cylinder stops.

- Loosen the adjusting screw (27) of the stroke adjustment with a hexagon socket spanner M3.
- Turn the graduated ring (41) in a way, that the 0 on the graduation covers the 0 on the graduated ring.
- Tighten the adjusting screw.

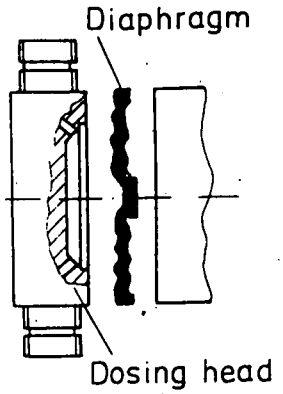

Figure 4

Service

The gear oil should be exchanged every 8000 operating hours, in dusty surroundings every 3000 operating hours.

At the same time, the dosing diaphragm (20) should be checked as a safety precaution.

After a maximum of 8000 operating hours, the dosing diaphragm should be replaced by a new one.

Diaphragm replacement

- Unscrew the closing screw (40), and collect the gear oil in a container.
- Re-screw the closing screw and tighten it well (do not forget the gasket).
- Shut the dosing lines at the suction and pressure side, loosen the cap nut of the suction and pressure valves.
- Loosen the 6 screws of the dosing head (22) and remove the dosing head (21).
- Remove the diaphragm and place the new diaphragm.(fig. 4)
- Place the dosing head and tighten the screws crosswise with a torque wrench (torque: 2 Nm).

Cleaning of the suction and pressure valves

- Unscrew the valve.
- Unscrew the valve seat with round pliers and clean it. If necessary, replace valve seat and ball by new ones.
- Replace the O-rings by new ones, and place the valve.

Overpressure valve

If no special opening pressure is mentioned in the order, the opening pressure of the overpressure valve is:

- 12 bar for KM 251-252/10 bar
- 18 bar for KM 251/16 bar
- 27 bar for KM 251/25 bar

It can be adjusted by the customer to the required opening pressure. For this purpose, a pressure gauge, and behind it a shut-off valve, have to be installed in the pressure line (figure 5).

The overpressure valve is then adjusted in the following way:

- Close the shut-off valve behind the pressure gauge.
- Remove the cover (25) of the overpressure valve
- Operate the pump.
- Slowly turn the adjusting nut of the overpressure valve with the above mentioned special tool clockwise, until the required opening pressure is achieved.

Note:
During the adjustment, do not block the overpressure valve.

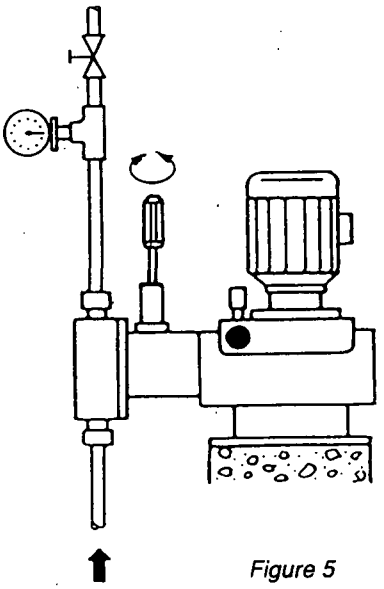

Figure 5

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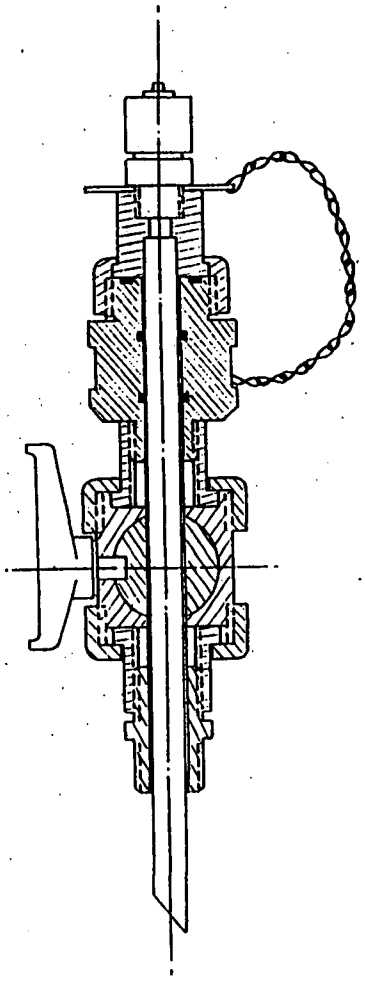
WITHDRAWABLE INJECTION QUILLS



DESCRIPTION	PART NO.	CODE
DN4 INJECTION QUILL (WITHDRAWABLE) A fully withdrawable injection lance to enable chemical solutions to be dosed into the centre of water flow. Also allows ease of cleaning. Pipe fittings ¾" BSPM. Also fitted with a standard ALLDOS DN4 N/R valve to prevent backflow. Use Alldos DN4 connections.	AC522-009W	A
DN8 INJECTION QUILL (WITHDRAWABLE) As for DN4 but having standard Alldos DN8 V/R valve to prevent backflow. Use Alldos DN8 connections.	AC522-031W	A
CARBON DIOXIDE INJECTION QUILL (WITHDRAWABLE) As for DN8 injection quill but has gas diffuser at end of probe and connection for 3/8" P.E.. Tube	AC522-031W-CO_2	A
DN20 INJECTION QUILL (WITHDRAWABLE) A fully withdrawable injection lance to enable chemical solutions to be dosed into the centre of water flow.. Also allows ease of cleaning. Pipe fitting 1" BSPM. Chemical entry - standard Alldos DN20 Use adaptors DN20-21 DN20-22 or DN20-23	AC522-141W	A
DN50 INJECTION QUILL (WITHDRAWABLE) As for DN20 but with pipe fitting - 2" BSPM Chemical Entry - 1½" BSPM	AC522-194W	A

NOTE: Withdrawable injection quills are manufactured from uPVC with EPDM seals. In DN4 and DN8 fittings, hastelloy C springs are used in the N/R valves. Please confirm chemical compatibility before use.

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APPENDIX 7

WII0288A.KPS

WITHDRAWABLE INJECTION QUILL

Withdrawable Injection Quill

Designed for installation at the point of chemical injection into a large diameter flow pipe, the 'Quill' allows the chemical to be dosed into the centre of the main flow, thus ensuring good mixing and preventing damage from local corrosion encrustation around the pipeline boss.

By means of the ball-type isolating valve and the seal block/union nut fitted, the 'Quill' may be withdrawn from the pipeline for cleaning/maintenance without the necessity of isolating the flow in the main pipeline. The 'Quill' passes through the ball in the valve, which must be closed when the 'Quill' has been withdrawn beyond it, and before it is totally removed.

Important Safety Provision

To prevent accidental total withdrawal of the 'Quill' before the valve has been closed, a chain is fitted to the assembly which should be adjusted on installation so that it is at its maximum length when the 'Quill' has been withdrawn just beyond the valve ball. When the valve has been closed, the chain may then be removed to allow the 'Quill' to be totally withdrawn. In addition a warning instruction to this effect is fitted to the unit.

Installation Notes:

1. It is important that the assembly is properly supported on installation to avoid accidental breakage which may occur it is simply protruding from the main pipeline unsupported. A clip-on PE pipe clip is supplied with the assembly to facilitate bracketing off to a wall or bulkhead as applicable.

2. For larger diameter pipes, a 'saddle' tee arrangement is recommended.

3. The connection provided on the outlet from the ball valve may be bushed to other sizes as applicable. (¾" BSP for DN4 & DN8, 1" BSP for DN20 & 2" BSP for DN50)

4. The standard 'Quill' length protruding from the valve outlet connection should be cut to length to suit, and chamfered to 60° before installation.

Summary Specification:

Withdrawable Quills are manufactured from grey uPVC components with EPDM seals. Viton or Hypolon seals may be specified.

All Quills can be manufactured in stainless steel if required.
In the DN4 and DN8 Quills, Hastelloy C springs are used in the non-return valves. Please check compatibility of all items before use.

Maximum Operating Pressure: 10 Bar

Please Note: The DN4 and DN8 injection valves incorporate a "loading/anti-siphon/non-return" valve which in itself provides a backpressure (load) of approximately 1 Bar. This load must be taken into account when calculating the overall discharge head.

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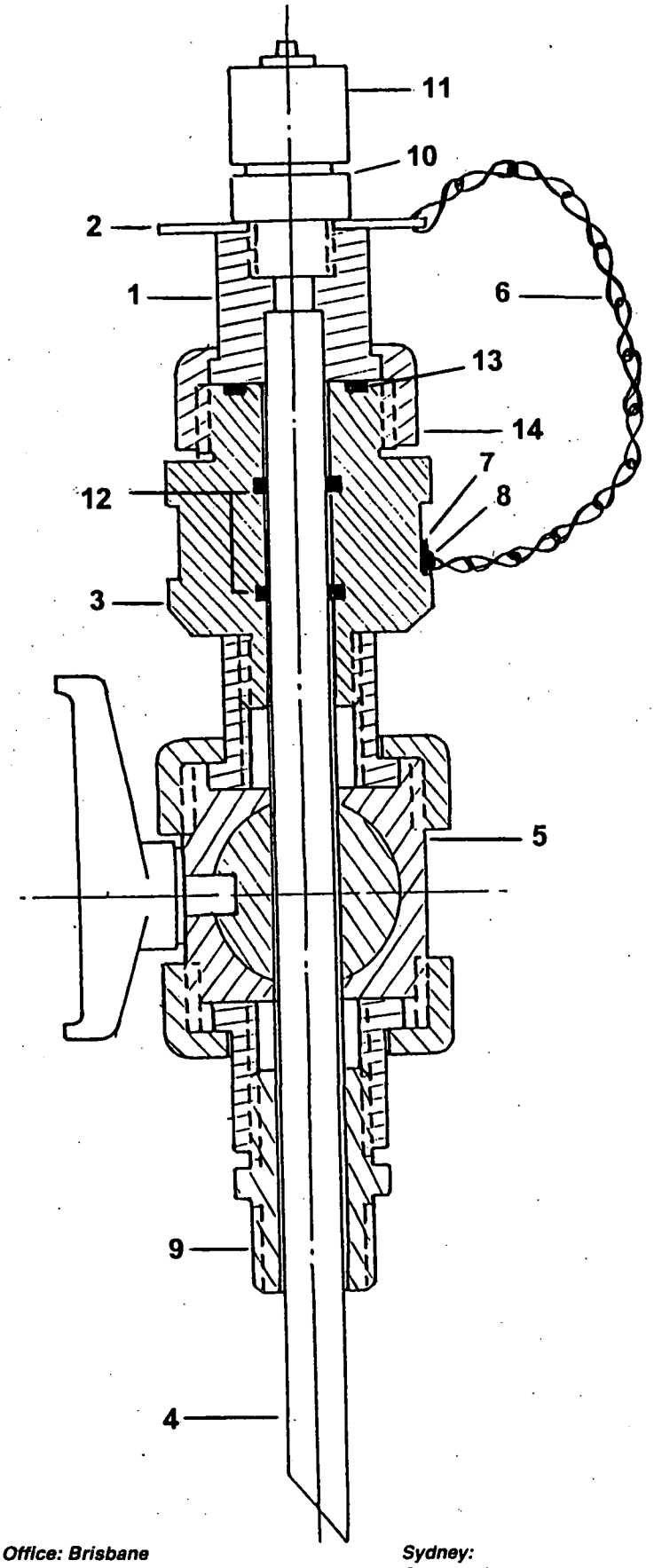

DN4 W/DRAW. INJECTION QUILL		
No	Code	Description
1	AC522-009W-01	INLET ADAPTOR
2	AC522-009W-02	CHAIN RETAINER
3	AC522-009W-03	VALVE ADAPTOR
4	AC522-009W-04	TUBE
5	F1-J3/4-001V	BALL VALVE 3/4
6	HZ-CHAIN-2.5X30	CHAIN 275MM
7	HH-0005200	WASHER M5 SS
8	HH-C3/1610003/4	SCREW SS
9	H3-J3/4-057V	NIPPLE 3/4 BSP
10	AA10.2419-401	CHECK VALVE DN4
11	AC529-004	CAP ASSY DN4
12	H5-3-BS113VITON	O RING VITON
13	H5-3-BS212VITON	O RING VITON
14	AA53.058-25	CAP NUT DN20
DN8 W/DRAW. INJECTION QUILL		
1	AC522-031W-01	INLET ADAPTOR
2	AC522-031W-02	CHAIN RETAINER
3	AC522-031W-03	VALVE ADAPTOR
4	AC522-009W-04	TUBE
5	F1-J3/4-002V	BALL VALVE 3/4
6	HZ-CHAIN-2.5X30	CHAIN 275MM
7	HH-0005200	WASHER M5 SS
8	HH-C3/160001/2	SCREW SS
9	H3-J3/4-057V	NIPPLE 3/4 BSP
10	AA10.543-41	CHECK VALVE DN8
11	AC529-001	CAP ASSY. DN8
12	H5-3-BS113VITON	O RING VITON
13	H5-3-BS212VITON	O RING VITON
14	AA53.058-25	CAP NUT DN20
DN20 W/DRAW. INJECTION QUILL		
1	AC522-141W-01	INLET ADAPTOR
2	AC522-141W-02	CHAIN RETAINER
3	AC522-141W-03	VALVE ADAPTOR
4	AC522-141W-04	TUBE
5	F1-L1-002S	BALL VALVE 1"
6	HZ-CHAIN-2.5X30	CHAIN 440MM
7	HH-005200	WASHER M5 SS
8	HH-C3/1610001/2	SCREW SS
9	H3-L1-057V	NIPPLE 1"BSP
12	H5-3-BS120VITON	O RING VITON
13	H5-3-BS118VITON	O RING VITON
14	AA53.058-25	CAP NUT DN20
DN50 W/DRAW. INJECTION QUILL		
1	AC522-194W-01	INLET ADAPTOR
2	AC522-194W-02	CHAIN RETAINER
3	AC522-194W-03	VALVE ADAPTOR
4	AC522-194W-04	TUBE
5	F1-P2-002V	BALL VALVE 2"
6	FZ-CHAIN-2.5X30	CHAIN 580MM
7	HH-005200	WASHER M5 SS
8	HH-C3/1610003/4	SCREW SS
9	H3-P2-057G	NIPPLE 2"BSP
12	H5-3-BS131VITON	O RING VITON
13	H5-3-BS226VITON	O RING VITON
14	AC522-194W-05	CAP NUT

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APPENDIX 7

GEMÜ®

Plastic Solenoid Valve

3/2 way, directly controlled

Description

Directly controlled 3/2 way plastic solenoid valve for inert gases, with emergency manual operator.
Due to the low power consumption it can be controlled by computers. Control functions: normally open and normally closed.

Construction

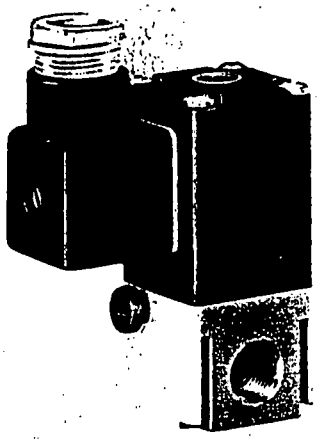
The uniform basic construction of all three types in the series 320/322/324 makes many applications possible without special additional components.

The valve consisting of the solenoid system with a plastic cover and the valve body is very easy to dismantle so that the parts can be replaced separately. In addition to automatic operation the valve can be opened or closed manually. Threaded inserts in the valve body provide an additional mounting facility for panels and standard tracks. The various possibilities for connection provide optimal installation conditions.

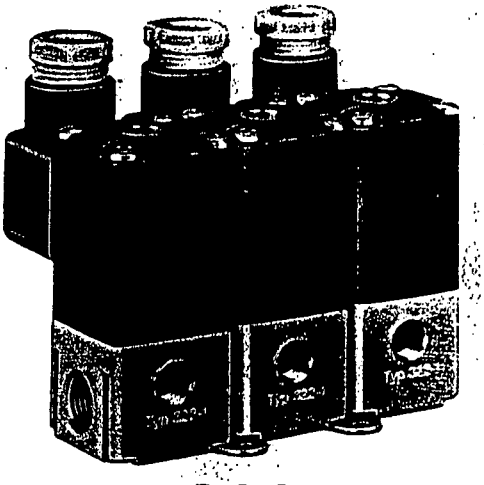
Type 320: Connections: threaded sockets
Straight through configuration
Suitable for single valve applications

Type 322: Connections: threaded sockets
Inlet and outlet arranged at an angle of 90°
Suitable for battery mounting
May also be used as a single valve

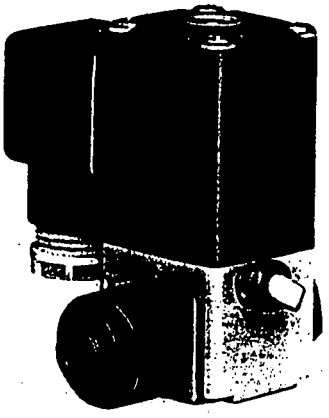
Type 324: Connections: threaded sockets
Inlet and outlet arranged at an angle of 90°
Suitable for direct mounting on process valve by hollow screw with ¼" or ⅛" BSP thread



Type 320

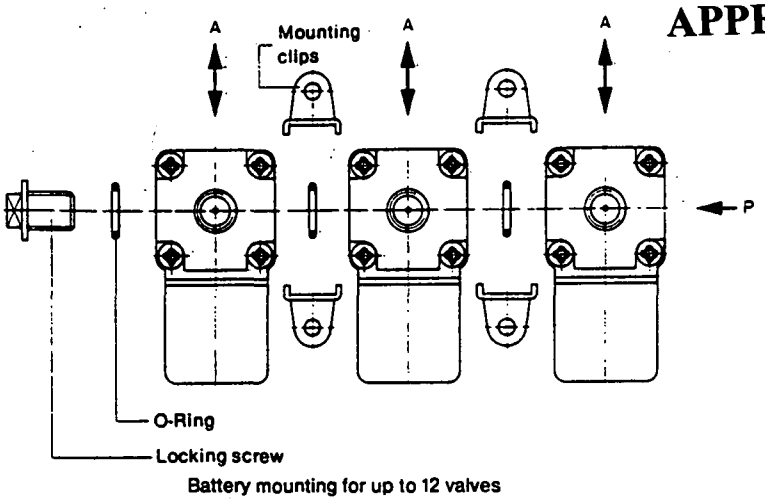


Type 322



Type 324

Mounting Instructions, Type 322, Battery Mounting



Battery mounting for up to 12 valves

The items required for battery mounting (2 mounting clips, 1 O-ring and 1 locking screw per valve) are supplied with type 322 when specified.

Construction of a battery: Stand the valves upside down, insert the O-ring in the groove on the connection side. Press the adjacent valve with the connection side without groove against the first valve with the O-ring inserted and fix the clips in the cutouts on the body. After positioning the two clips, push them fully home.

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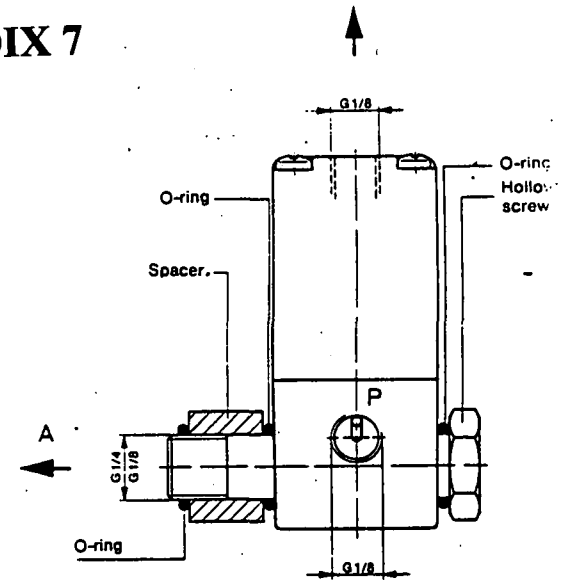
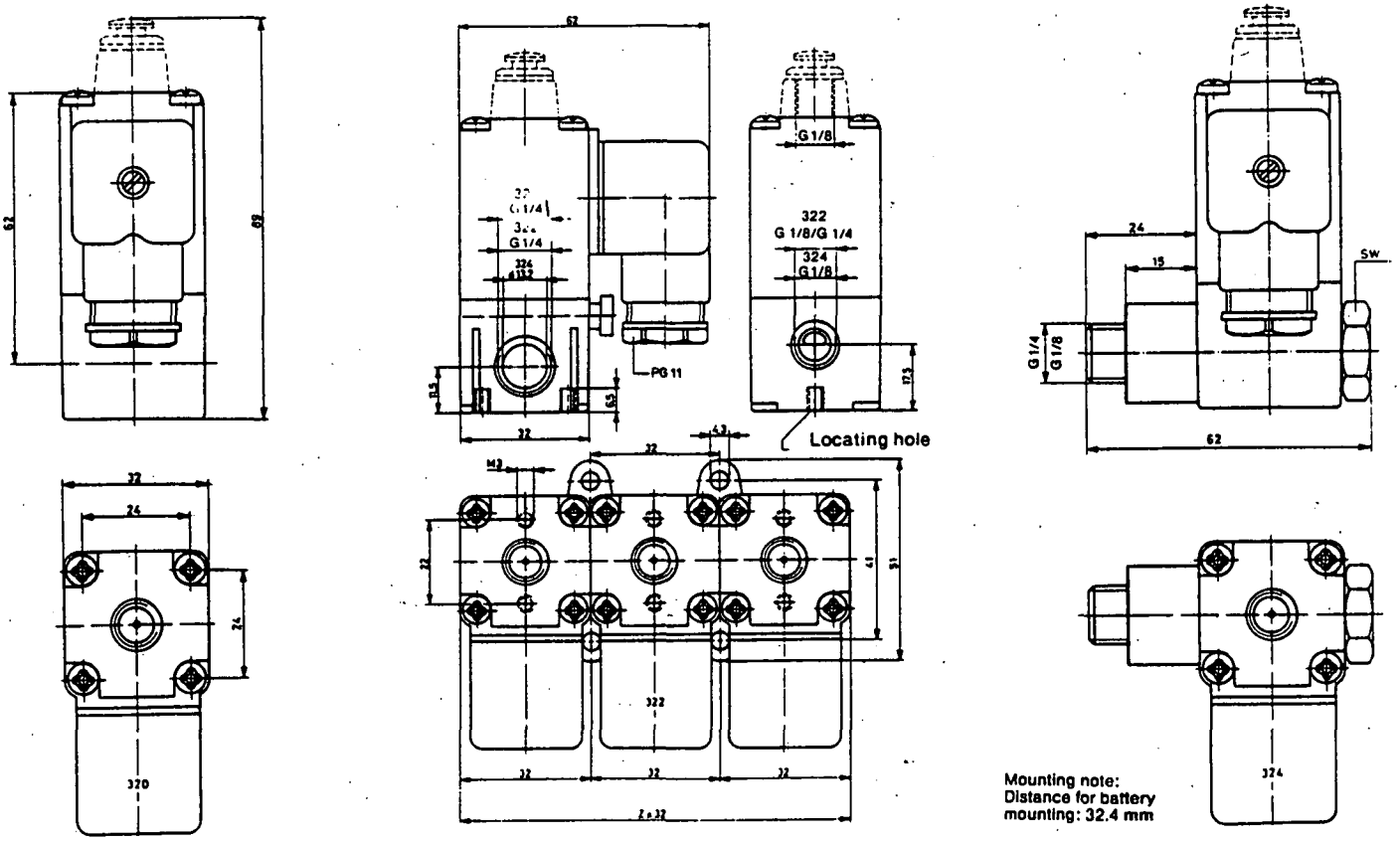
Mounting Instructions, Type 324



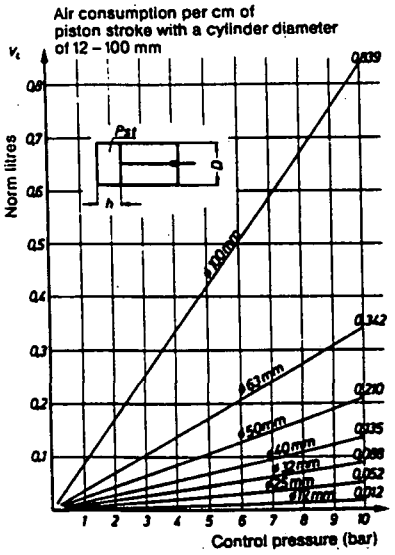
Type 324 is supplied with the items required for mounting: (1 hollow screw, 3 O-rings, 1 spacer). Mounting of the valve is carried out as follows: Slide the O-ring onto the hollow screw and push the hollow screw through the valve body. Place the second O-ring on the hollow screw and apply the spacer. Position the seal and screw on the valve by means of the hollow screw.

Dimension Sheet, types 320, 322, 324



Mounting note:
Distance for battery mounting: 32.4 mm

APPENDIX 7



For sizing control systems it is sometimes important to know the air consumption of the components being controlled. For piston actuators the air consumption can be determined with the aid of the diagram and the given formula. The diagram shows cylinder diameters of 12 to 100 mm. The vertical axis provides the air consumption in N litres per cm of piston stroke at the relevant control pressure, which is shown on the horizontal axis. In order to calculate the total consumption per stroke, the value VL is multiplied by the piston stroke h.

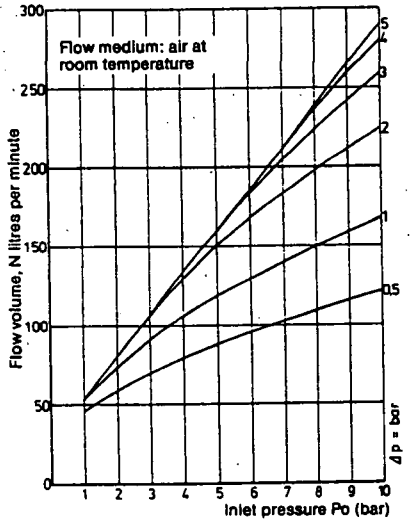
$V_{ges} = V_L \cdot h$ (N)

V_{ges} = Air consumption in N litres

V_L = Air consumption per cm of stroke

h = Stroke in cm.

An allowance should be added to the air consumption if extended control lines ared used.



The flow quantity given in N litres per minute for gas can be read off the second figure. The K_v-value on which the graph calculation is based is K_v = 2.0 l/min.

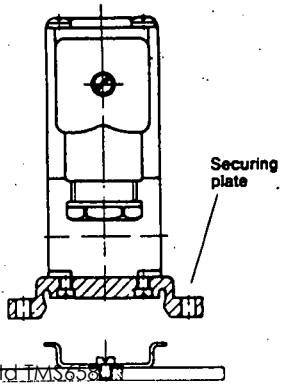
The flow quantity for other gases and temperatures can be calculated according to the following formula:

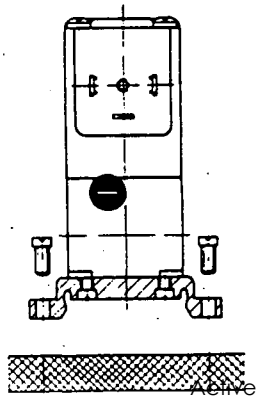
Formula $Q_N = 514 \cdot K_V \sqrt{\frac{\Delta p \cdot p_2}{\rho \cdot (273 + t)}}$

The values in this formula are as follows:

Q_N = Flow quantity in Nm^3
K_V = K_V-value in m^3/h
p_2 = Pressure down stream of the valve in kp/cm^2 (absolute pressure)
Δp = Pressure loss in kp/cm^2
ρ_N = Density in kg/Nm^3
t = Temperature in °C.

The formula applies to $\Delta p < \frac{p_1}{2}$
whereby p_1 is the upstream pressure (connection P)





Fitting Arrangements

According to requirements, it is possible to secure the units either to panels or standard track (track type 35, DIN 46 247) by means of a plastic securing plate (accessory part number 1050).

APPENDIX 7

GEMÜ®

Electrical Position Indicator

Description

Two positions: open and/or closed can be indicated by GEMÜ type 1201 electrical position indicator.

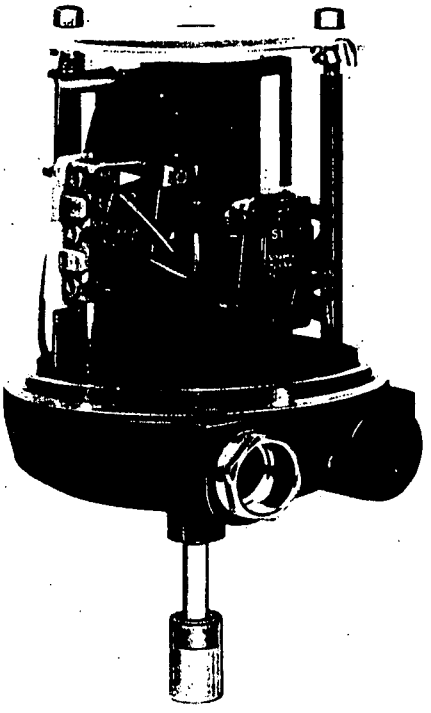
Construction and Function

The GEMÜ type 1201 electrical position indicator is designed in such a way that it can be retrofitted to GEMÜ valves by means of a threaded rod, without the need for any modifications. The switching rod is thereby connected to the valve spindle via a universal coupling, without play in the axial direction.

The switching units consist of two micro-switches with a polyamid sprocket wheel and a powerful tumbling mechanism with silver contacts for high switching frequencies of up to 10^7. Both switches are fitted to a continuously adjustable holder and are independently adjustable via threaded spindles for a maximum stroke of 70 mm. The trigger cam is designed in such a way, that the possibility of damage when sliding the trigger cams over the switches, is excluded.

Switches, switching rods and terminal block are mounted on a 360° rotatable plastics socket, covered by a transparent cap, thereby enabling a clear observation of the trigger cams.

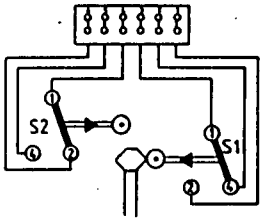
The electrical connection can be carried out via one or, if preferred, two cable glands PG 13.5 at the built-in terminal block. The micro-switches are already wired up with the terminal block. Electrical protection class of GEMÜ type 1201 position indicator is IP 65. The position indicator can be used in ambient temperatures of –20 °C up to +60 °C.



Contact Ratings

Voltage Volts	Resistance Amps.	Glow Lamp Duty Amps.	Inductive Duty Amps.
125 ~	10	1	10
250 ~	10	1	10
380 ~	6	–	6
15 =	15	1.5	15
30 =	8	1.5	7.5
50 =	3	0.8	2.5
75 =	1	0.6	0.5
125 =	0.5	0.5	0.07
250 =	0.25	0.25	0.03

Wiring Diagram



Switches S 1 and S 2 connected with terminal block

Type 1201

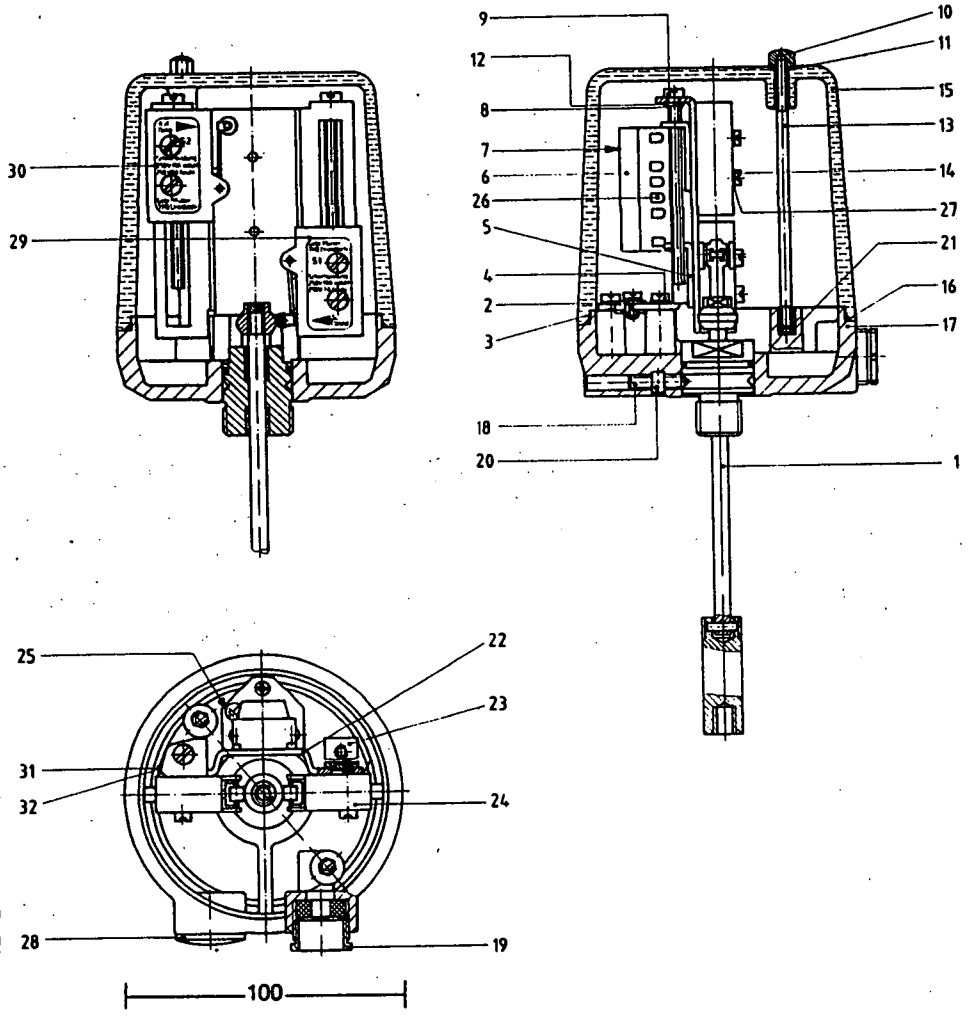
APPENDIX 7

Mounting

1. Mounting of position indicator
The spindle assembly (1) is screwed into the threaded piece of the valve spindle, the threaded shouldered pin is screwed into the thread in the actuator. The entire position indicator is plugged to the threaded shouldered pin and locked with set screw (18). Before rigidly fixing the position indicator, it should be rotated to the most convenient position, either with respect to the visibility of the optical indicators, or the direction of the cable entry. The position indicator is 360° rotatable. Pull connecting cable through PG gland and connect in accordance with wiring diagram.

2. Fitting of position indicator to another valve type
Within the specific type range, the position indicators can be used without modification. However, for other types, the entire spindle assembly (1) must be changed.

3. To adjust stroke
Loosen screws (14) and adjust limit switch (24) with screws (9) upwards until switching pulse is obtained. Adjust limit switch in this position by tightening the screws (14).



Position	Part
1	Spindle assembly
2	Compression ring
3	Clamp washer
4	Screw
5	Wiring diagram
6	Terminal block
7	Screw
8	Washer
9	Screw
10	Nut
11	Washer
12	Washer
13	Set screw
14	Screw
15	Cover
16	O-ring
17	Housing
18	Set screw
19	PG 13.5 gland
20	Nut
21	Insert nut
22	Bottom plate
23	Angle bracket
24	Limit switch
25	Earthing sign
26	Cable
27	Spring washer
28	Cap
29/30	Type label
31	Insulating screw
32	Insulating sheaths/ tubing

Ordering Information

The electrical position indicator is available in the following types:
Type 1201/000/Z 01 Open and closed
Type 1201/000/Z 02 Open
Type 1201/000/Z 03 Closed

When ordering, please state full valve type specification,
e. g. Type 1201/000/Z 01 to be used for type 690/20 D 0114-1

APPENDIX 7

GEMÜ®

Montageanleitung
Assembly Instructions

690/695
DN 15–80

Hinweis: Die Demontage des Steuerkopfes muß unter einer Presse erfolgen, da der Antrieb unter Federspannung steht.

Please note: *Dismantling of the actuator must be undertaken using a press as the actuator is under spring tension.*

I. Montage Ventil

1. Spindel (15) mit Membrane (14), Membranteller (6), Dichtscheiben (22), Federring (9) Scheibe (48) und Uni-Stop-Mutter (21) verschrauben.

2. In Unterteil (16), Quadring (4) mittels Werkzeug einbringen.

3. Stößel gefettet mit Membrane kpl. vorsichtig durch Spindelbohrung des Unterteils (16) einführen.

4. Druckfeder (7), (8), (17) und (26) einlegen, Haube (10) zentrisch mittels Handpresse, in den Schraubenbohrungen fluchtend, auf Unterteil (16) pressen und mit Schrauben (11/12) gleichmäßig überkreuz festschrauben.

5. Stößel (31) in die Spindel (15) einlegen und Zylinderstift (30) einstecken.

6. Druckstück (3) über die Spindel stecken und Absperrmembrane (2) in den Stößel (31) einschrauben.

7. Ventilkörper (1) auf Ventil aufsetzen, ausrichten und mit den Schrauben (18) festschrauben.

II. Einbauhinweise

1. Einbaulage:
Das Ventil kann in jeder Lage eingebaut werden.

2. Durchfluß:
Das Ventil kann in beiden Durchflußrichtungen eingesetzt werden.

3. Betriebsdruck:
Der max. zul. Druck darf nicht überschritten werden. Er ist auf dem Typenschild angegeben.
Alle Angaben zum Betriebsdruck verstehen sich einseitig am Ventil anstehend.

4. Fremdsteuerdruck:
Der min. und max. Steuerdruck ist ebenfalls auf dem Typenschild angegeben und muß eingehalten werden.

III. Wartung

Das Ventil ist wartungsfrei.

I. Assembly

1. Assemble: Spindle (15), diaphragm (14), diaphragm plate (6), washers (22), locking washer (9), washer (48) and locking nut (21).

2. Insert quadring (4) into lower part assembly (16) with tools.

3. Grease diaphragm assembly stem and carefully insert diaphragm assembly into spindle hole in lower part assembly (16).

4. Insert springs (7), (8), (17) and (26), locate cover (10) centrally using a fly-press over the screw holes then push to lower part and tighten screws (11/12) diagonally.

5. Insert stem (31) into spindle (15) and insert pin (30).

6. Position pressure piece (3) over spindle (15) and screw diaphragm (2) into stem (31).

7. Position valve body (1) to actuator assembly, line up and secure with screws (18).

II. Operating Instructions

1. Mounting position:
The valve can be mounted in any position.

2. Direction of flow:
The valve can be used for flow in both directions.

3. Working pressure:
The maximum permissible pressure (as indicated on the valve type label) must not be exceeded.
All specifications relating to operating pressure indicate pressure levels applied on one side of the valve.

4. Control pressure:
The minimum and maximum control pressures (also indicated on the valve type label) must be adhered to.

III. Maintenance

The valve is maintenance-free.

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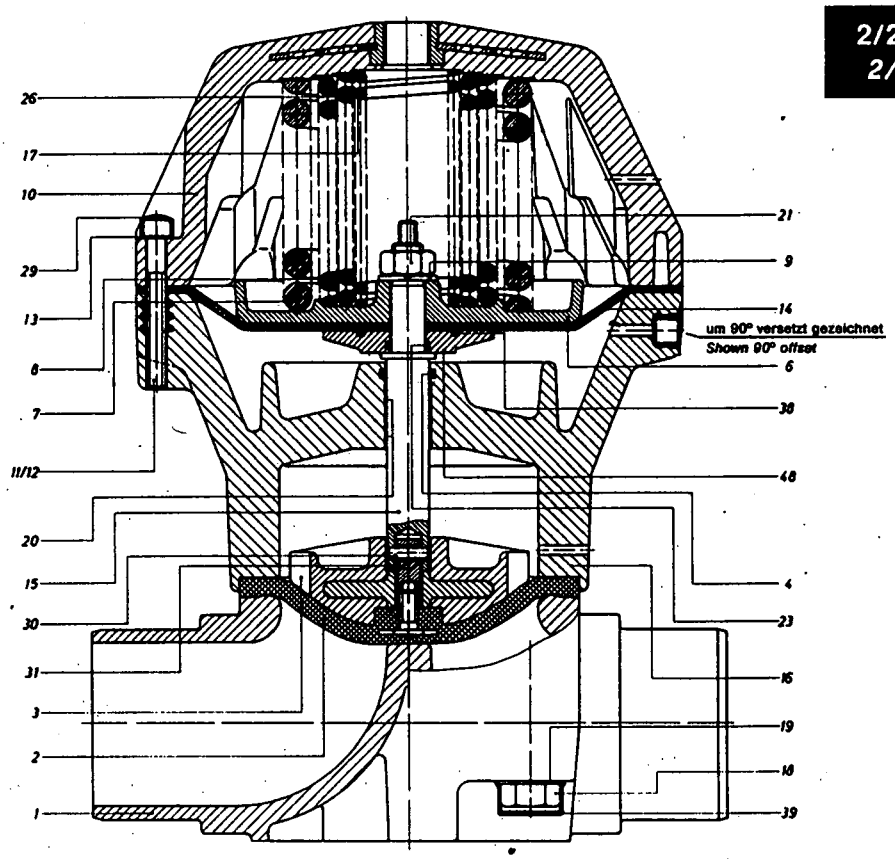
GEMÜ®

Ersatzteilliste
Spare Parts List

690/695
DN 15–80

2/2-Wege
2/2-way



Kunststoff-Membranventil Typ 690
Metall-Membranventil Typ 695

Plastic diaphragm valve type 690
Metal diaphragm valve type 695

Pos.	Bezeichnung	Anzahl	*Item:*	*Description:*	*Qty.:*
1	Ventilkörper	1	*1*	*Valve body*	*1*
2	Absperrmembrane	1	*2*	*Diaphragm*	*1*
3	Druckstück	1	*3*	*Pressure piece*	*1*
4	Quadring	1	*4*	*Quadring*	*1*
5	Sicherungsring	1	*5*	*Washer*	*1*
6	Membranteller	1	*6*	*Diaphragm plate*	*1*
7	Druckfeder	1	*7*	*Spring*	*1*
8	Druckfeder	1	*8*	*Spring*	*1*
9	Federring	1	*9*	*Locking washer*	*1*
10	Haube	1	*10*	*Cover*	*1*
11	I-Sechskantschraube	8	*11*	*Int. hexagon screw*	*8*
12	I-Sechskantschraube	4	*12*	*Int. hexagon screw*	*4*
13	U-Scheibe	12	*13*	*Washer*	*12*
14	Membrane	1	*14*	*Diaphragm*	*1*
15	Spindel kpl.	1	*15*	*Spindle assembly*	*1*
16	Unterteil kpl.	1	*16*	*Lower part assembly*	*1*
17	Druckfeder	1	*17*	*Spring*	*1*
18	Sechskantschraube	4	*18*	*Hexagon screw*	*4*
19	Federring	4	*19*	*Washer*	*4*
20	DU-Buchse	2	*20*	*D. U. bearing*	*2*
21	Sechskantmutter	1	*21*	*Hexagon nut*	*1*
23	O-Ring	1	*23*	*O-ring*	*1*
26	Druckfeder	1	*26*	*Spring*	*1*
29	Abdeckkappe	4	*29*	*Cap*	*4*
30	Zylinderstift	1	*30*	*Pin*	*1*
31	Stößel	1	*31*	*Stem*	*1*
38	O-Ring (nur DN 65–80)	1	*38*	*O-ring (DN 65–80 only)*	*1*
39	Abdeckkappe (nur Typ 690)	4	*39*	*Cap (Type 690 only)*	*4*
48	Scheibe (nur DN 65–80)	1	*48*	*Washer (DN 65–80 only)*	*1*

Bei Ersatzteilbestellungen genaue Daten nach Typenschild angeben!

When ordering spare parts, please give exact details from type label!

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APPENDIX 7

GEMÜ®

Plastic Diaphragm Valve

Pneumatically operated

Description

Pneumatically operated plastic diaphragm valve, for inert or corrosive liquids and gases.

Construction

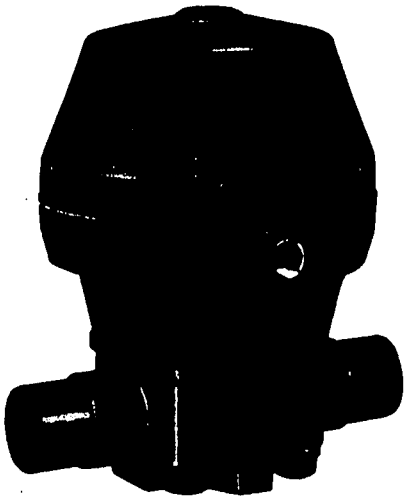
The valve is of compact design and being manufactured from plastic materials throughout is free from corrosion.

Operation is by means of a maintenance-free diaphragm actuator which can be controlled by any inert liquid or gaseous medium.

The valve body and sealing diaphragm are available in various materials to suit the chemical and thermal requirements.

The valve body can be supplied with alternative connection arrangements:

- Standard connection spigots for cement or solvent weld in accordance with DIN 3441 or 3442
  Range of sizes: DN 15 to DN 100 in materials: PVC, PP, PVDF
  Range of sizes: DN 15 to 25 in PFA (imperial)
- Threaded union (externally threaded spigot with coupling union)
  PVC, DN 15 to DN 50, with cemented socket insert
  PP, DN 15 to DN 25, with welded socket or welded spigot insert
- Clamp connection (see GEMÜ Clean System leaflet)



Advantages

- Unaffected by heavily contaminated, abrasive media
- High flow rate
- Either direction of flow and also any mounting position can be used
- Compact, weight saving design
- Different methods of connection of the valve are possible
- Body with integrated mounting facility
- Body and diaphragm sizes have coordinated diameters. Hence fitting time is reduced because the pipe and fixing distances remain the same. Storage inventory is also reduced.
- Wide range of accessories, such as;
  - electrical remote indication
  - electrical indication of valve position with micro-switches or proximity switches
  - NAMUR type mounting bracket
  - pneumatic, or electro-pneumatic position controller

Type 690

APPENDIX 7

Working Medium

Any inert or corrosive gases and liquids, depending on valve and diaphragm material.

Max. permissible temperature of working medium:
PVC 60 °C; PP, PVDF 80 °C; PFA 90 °C.

The valve will seal in both directions up to full working pressure.

Control Medium

Minimum pressure:		see table
Max. permissible pressure:		6 bar
Max. permissible temperature:		40 °C
Actuator volume:	DN 15 – 25	0.15 Nl
	DN 32 + 40	0.35 Nl
	DN 50	1.20 Nl
	DN 65 + 80	2.10 Nl
	DN 100	2.40 Nl

		Connection			Control function 1*		Control function 2+3			
Nominal-Diameter (mm)	Body Configuration D = straight through	Ref. no. 0 Spigots for cement or solvent weld, in PVC, PP or PVDF	Ref. no. 7 Threaded spigots with unions in PVC + PP (with cemented or welded socket ins.)	Ref. no. 71 Threaded spigots with unions in PP (with welded spigot insert)	Working pressure (bar)	Control pressure (bar)	Working pressure (bar)	Control pressure (bar)	K_V-Value (m^3/h)	Mass [C.f.1] (kg)
15	D	20	G 1	G 1	0–10		0–10		5.6	1.8
20	D	25	G 1¼	G 1½	0–10	min. 3 bar	0–10		8.2	1.8
25	D	32	G 1½	G 1½	0–10	max. 6 bar	0–10	max. 6 bar	10.5	1.8
32	D	40	G 2 PVC	-	0–10		0–10		18.0	4.0
40	D	50	G 2¼ PVC	–	0–10	see	0–10	see	25.0	4.0
50	D	63	G 2¾ PVC	–	0–10	diagram	0–10	diagram	46.0	7.4
65	D	75	–	–	0– 6	for values	0–10	for values	78.0	16.3
80	D	90	–	–	0– 6		0–10		120.0	16.3
100	D	110	–	–	0– 6		0–10		189.0	24.5

All pressures are gauge pressures, when applied upstream only (P 1 + P 2 = max. 10 bar). Versions for other working/control pressures on enquiry.

Valve Body Material

	Ref. no.
PVC	1
PP	5
PVDF	20*
PFA (see special datasheet GEMÜ Clean-System)	24

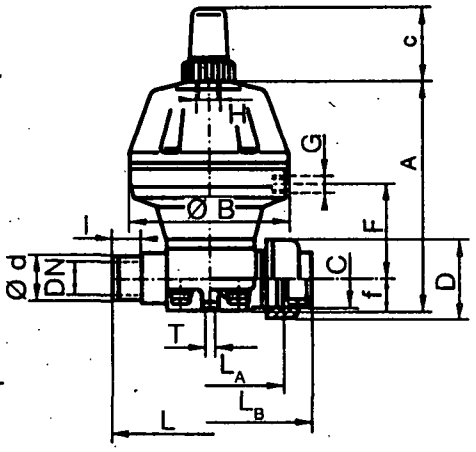
*Flanged versions are available from manufacturer only.

Diaphragm Material

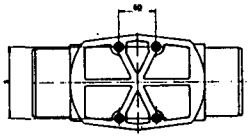
		Ref. no.
Hypalon	CSM	1
Perbunan	NBR	2
Viton	FPM	4
Teflon	PTFE	5
Ethylene-Propylene	EPDM	14

Control Function

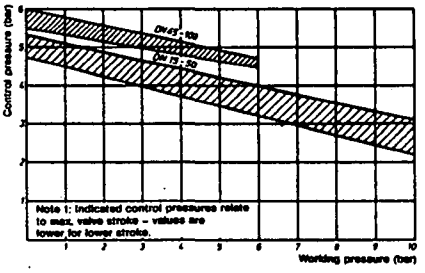
	Ref. no.
Normally closed	1
Normally open	2
Double acting	3



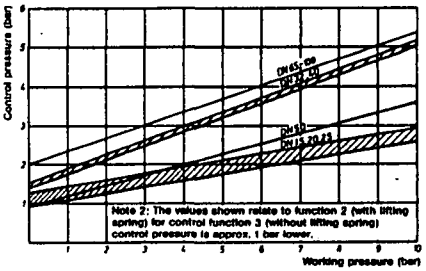
Note: 2 mounting holes provided for DN 15–80 and 4 for DN 100 (see below).



Control function 1



Control function 2 + 3



											L*								
DN	A	ØB	F	G	H	T	Ød	S	L*	PVC/T	PP/T	PP/TI	C	c	D	I	L	f
15	179	126	71	G¼	M16x1	M 6x12	20	25	108	146	125	196	G1	56	43	16	124	26
20	179	126	71	G¼	M16x1	M 6x12	25	25	108	152	154	228	G1¼	56	53	19	144	26
25	179	126	71	G¼	M16x1	M 6x12	32	25	116	166	158	234	G1½	56	60	22	154	26
32	248	155	108	G¼	M16x1	M 8x18	40	44.5	134	192	-	-	G2	56	74	28	174	40
40	248	155	108	G¼	M16x1	M 8x18	50	44.5	154	222	-	-	G2¼	56	83	31	194	40
50	301	210	132	G¼	M16x1	M 8x18	63	44.5	184	266	-	-	G2¾	80	103	38	224	40
65	380	258	187	G¼	M22x1.5	M12x22	75	100*	-	-	-	-	-	110	-	44	284	55
80	380	258	187	G¼	M22x1.5	M12x22	90	100*	-	-	-	-	-	110	-	51	300	55
100	481	258	288	G¼	M22x1.5	M10x18	110	120*	-	-	-	-	-	110	-	61	340	65

*–3 mm in material PP/PVDF

Ordering Example	690	15	D	0	1	14	1
Type	690						
Size (mm)		15					
Body configuration (D)			D				
Connection (ref. no.)				0			
Valve body material (ref. no.)					1		
Diaphragm material (ref. no.)						14	
Control function (ref. no.)							1

Ordering Information:

(For pilot valves, see types 320–324)

When ordering please specify:

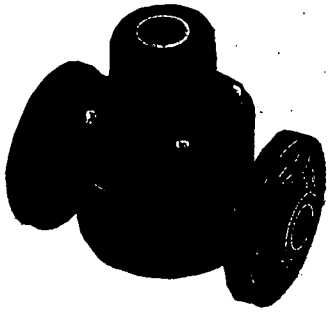
1. Working pressure
2. Working medium and temperature
3. Control pressure min./max.
4. Control medium

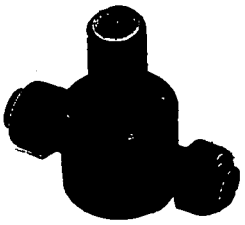
For accessories: see separate datasheet.

GEMÜ® VALVES, ACTUATORS AND CONTROL SYSTEMS

WATERTEC ENGINEERING Pty Ltd

Incorporated in NSW - **Specialising in - Chemical Systems Engineering - ALLDOS Metering and Control Equipment - OZGEN Ozone Generation Equipment**





VALVES 525
Pressure Retention or Pressure Relief for Dosing Pumps

Watertec 525 Valves are designed for use with **Alldos** dosing pumps. They are fitted into the pump discharge line as a pressure retention valve if the pressure differential between suction and discharge is less than 1 bar. The valve prevents siphoning and ensures accuracy of the dosing output. It also ensures a harmonic dosing flow by means of the regulating function of the diaphragm/spring system.

They are also used as a pressure relief valve to release at a pre-set limit, preventing damage or contamination from a pressure overload.

Operation & Adjustment

The Watertec 525 valves work according to the back pressure principle. Pressure is built up in the valves diaphragm chamber until it exceeds the spring pressure, thus opening the valve. Pressure retention valves are factory set to 2 bars whilst pressure relief valves are set to 6 bar. When ordering please specify what pressure is required. They can be factory set to any nominated pressure or re-adjusted by the adjusting screw (see drawing) on site. Maximum setting 8 bar.

Important: The 525 valve does not function as a shut-off valve. Therefore the adjusting screw must not be overtightened.

Design Variants

The 525 valves are available in various sizes and materials (see chart). The standard diaphragm is PTFE with an EPDM backing disc. For porting sizes see chart, some variations are available using Watertec fittings.

INSTALLATION

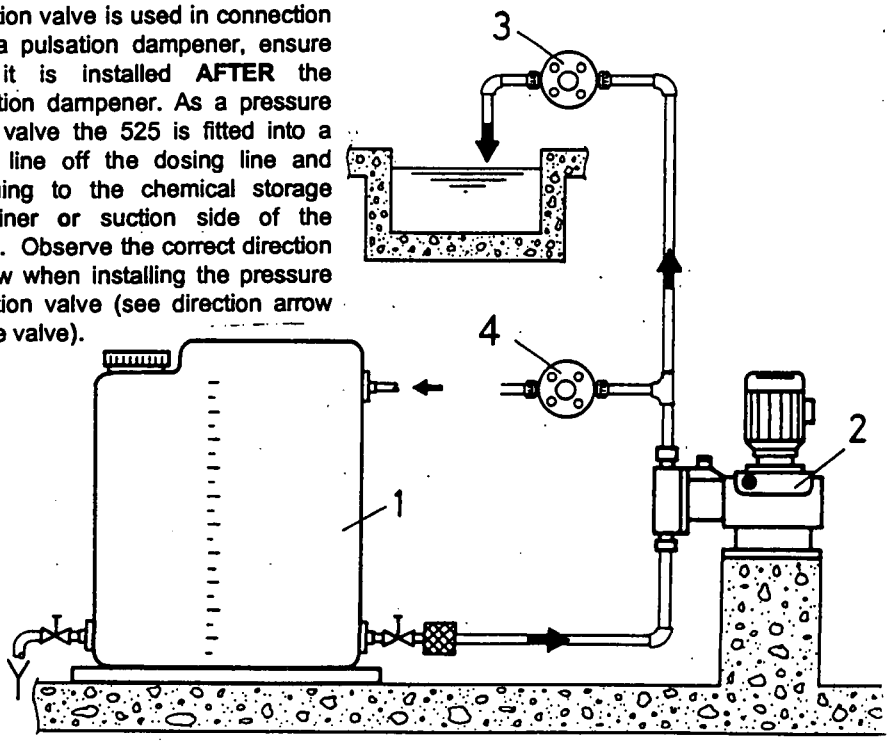
The pressure retention valve should be installed directly before the point of injection so that the dosing line is not emptied when the pump is switched off. If the pressure retention valve is used in connection with a pulsation dampener, ensure that it is installed **AFTER** the pulsation dampener. As a pressure relief valve the 525 is fitted into a Teed line off the dosing line and returning to the chemical storage container or suction side of the pump. Observe the correct direction of flow when installing the pressure retention valve (see direction arrow on the valve).

1 Chemical container

2 Dosing pump

3 Pressure retention valve

4 Pressure relief valve



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MURRUMBEENA VIC Aust 3136
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Order Data for 525 Valves

APPENDIX 7

Valve Code	Size DN	Material Upper/Body	Diaphragm	Port Connection	Repair Kit Code
AC525-0567W	8	PVC/PVC	PTFE	HOSE 12X6	AB553-080W
AC525-0567WSD	8	PVC/PVC	SS	HOSE 12X6	AB553-080WSD
AC525-0571-1W	8	PVC/SS	PTFE	¼" BSP	AB553-080W
AC525-0571-2W	8	SS/SS	PTFE	¼" BSP	AB553-080W
AC525-1113W	20	PVC/PVC	PTFE	20mm PVC PIPE SWJ	AB553-200W
AC525-1113WSD	20	PVC/PVC	SS	20mm PVC PIPE SWJ	AB553-200WSD
AC525-2133W-1W	20	PVC/SS	PTFE	3/4" BSP	AB553-200W
AC525-2133W-2W	20	SS/SS	PTFE	3/4" BSP	AB553-200W
AC525-1223W	32	PVC/PVC	PTFE	32mm PVC PIPE SWJ	AB553-320W
AC525-1223WSD	32	PVC/PVC	SS	32mm PVC PIPE SWJ	AB553-320WSD
AC525-1243W	32	PVC/PVC	PTFE	FLANGE 529-423W	AB553-320W
AC525-2233W	32	SS/SS	PTFE	1¼" BSP	AB553-320W
AC525-2243W	32	SS/SS	PTFE	FLANGE 529-423W	AB553-320W
AC525-1263W	50	PVC/PVC	PTFE	50mm PVC PIPE SWJ	AB553-500W

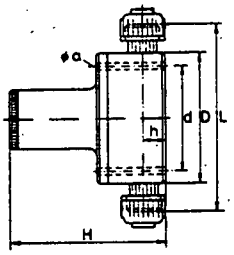
Repair kit consists of diaphragms, spring, spring adjuster and O'rings (if applicable).

DIMENSION DATA 525 VALVES

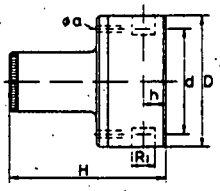
Valve Code	L [mm]	Ø D [mm]	H [mm]	h [mm]	d [mm]	Ø a [mm]	Wght. [Kg]
525-0567W	100	68	106	19	50	6.0	0.4
525-0571-1W		68	106	19	50	6.0	0.9
525-0571-2W		68	106	19	50	6.0	1.0
525-1113W	140	90	155	39	77	6.0	1.0
525-2133-1W		90	155	39	77	6.0	2.7
525-2133-2W		90	155	39	77	6.0	3.7
525-1223W	216	148	194	37	127	9.0	3.3
525-1243W	229	148	227	70	127	9.0	3.5
525-2233W		148	194	37	127	9.0	10.1
525-2243W	200	148	227	70	127	9.0	12.6
525-1263W	226	148	214	43	127	9.0	3.7

The Manufacturer reserves the right to change the dimensions at any time.

DN8,20,32,50 PVC



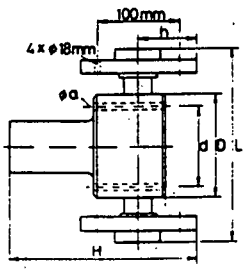
DN8,20,32 SS



Alternative Fittings for 525 Valves

Size DN	525 Material	Code	Fitting Type
8	PVC	H1-DN8-19	3/8 Hose Tail PVC C/W Cap
8	PVC	H1-DN8-13	1/2 Hose Tail PVC C/W Cap
8	PVC	H1-DN8-16	5/8 Hose Tail PVC C/W Cap
8	PVC	H1-DN8-11	1/2 BSP F PVC Adatpor C/W Cap
8	PVC	H1-DN8-12	15mm PVC SWJ Adaptor C/W Cap
8	PVC	H1-DN8-17	1/4 BSP F PVC
8	PVC	H1-DN8-18	1/4 BSP F SS
20	PVC	H1-DN20-23	3/4 Hose Tail PVC
20	PVC	H1-DN20-21	3/4 BSP M PVC Adaptor
20	PVC	H1-DN20-24	3/4 BSP F PVC Adaptor
20	PVC	H1-DN20-25	3/4 BSP F SS Adaptor

Inquire about fitting changes at your local Watertec agent.



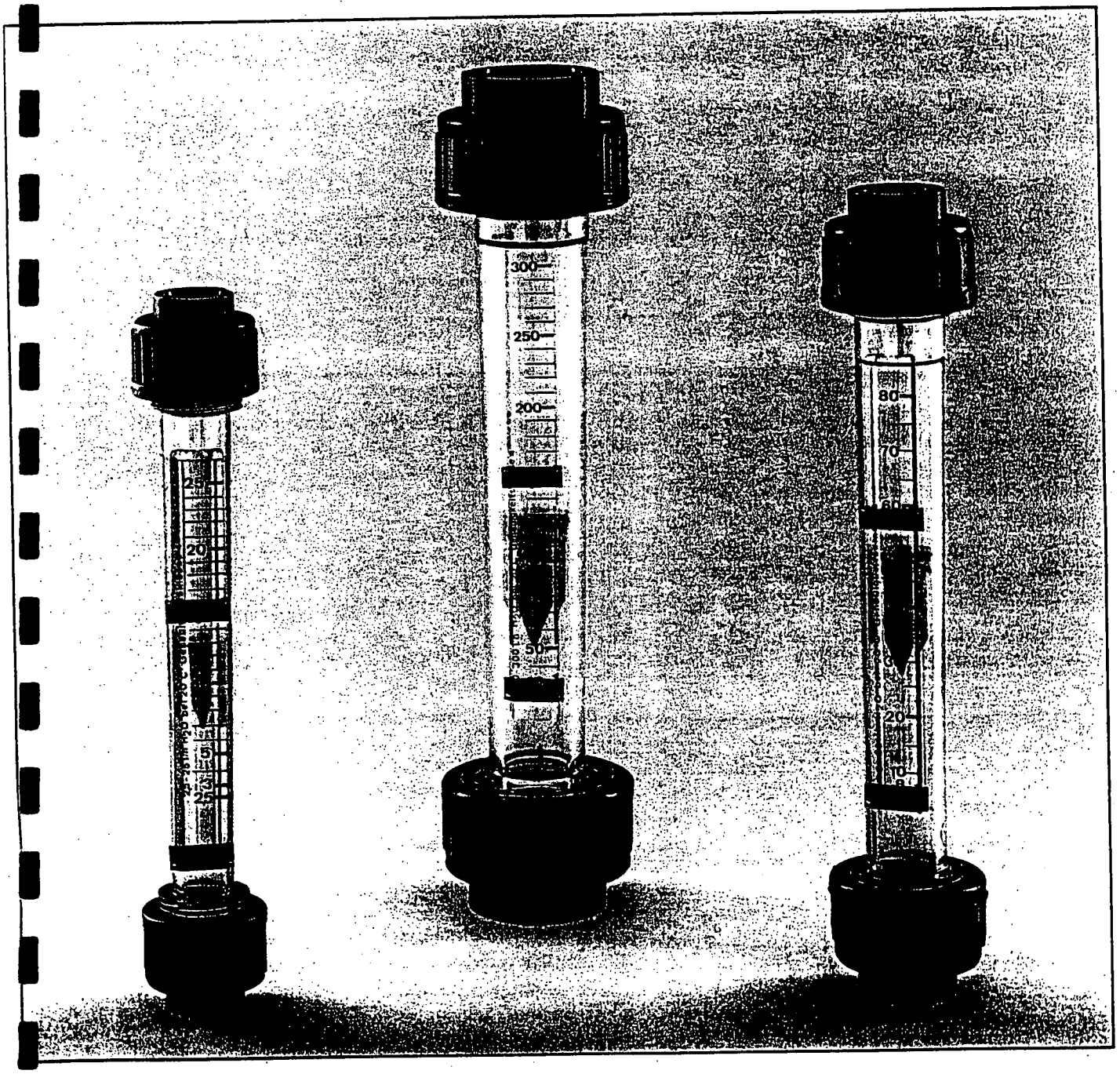
DN32 PVC FLANGED

APPENDIX 7

Plastic flowmeters and switches

KOBOLD

FLOW
PRESSURE
LEVEL
TEMPERATURE
measurement
monitoring
control



Type:
KSK

APPENDIX 7

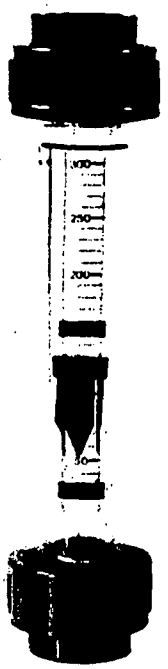
Construction and mode of operation

KOBOLD plastic flowmeters and switches are based on the well known »suspended float« principle.

They are used for measuring and monitoring flows in closed pipes.

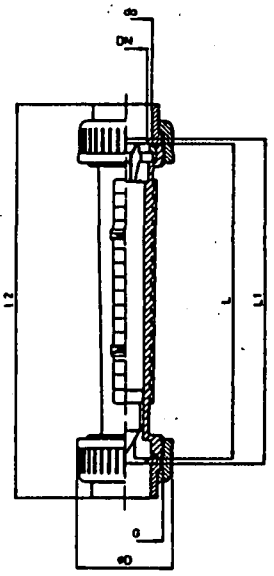
The media flows, from below, through a conical plastic measuring tube. This raises the float and the flow rate can be read off against a scale on the flowmeter. The indication point is at the greatest diameter of the float.

The instruments can be fitted with bistable switches in order to monitor flow limiting values.



Special advantages

- Rugged and corrosion proof
- May be inserted/removed radially
- Special scales can be attached
- Guide rail for accessories
- Easy assembly
- Plastic float and fittings generally made of PVDF



Order Number	Flow rate l/hr	DN	d	L	L1	L2	D	G	Pressure drop mm wc
KSK 2015	1.5– 15	10	16	165	171	199	35	R ¾"	46
KSK 2025	2.5– 25	10	16	165	171	199	35	R ¾"	46
KSK 2050	5.0– 50	10	16	165	171	199	35	R ¾"	46
KSK 2080	8.0– 80	15	20	185	191	223	43	R 1"	45
KSK 2100	10.0– 100	10	16	165	171	199	35	R ¾"	46
KSK 2150	15.0– 150	15	20	185	191	223	43	R 1"	45
KSK 2200	20.0– 200	15	20	185	191	223	43	R 1"	45
KSK 2300	30.0– 300	25	32	200	206	250	60	R 1½"	83
KSK 2500	50.0– 500	25	32	200	206	250	60	R 1½"	83
KSK 2999	100.0–1000	25	32	200	206	250	60	R 1½"	83

without connectors

Options	Order Number mounted	Spare
contact	KSK 5000	KSK 5100
contact relay, 220 VAC		KSK 5135
connectors		
– 2 screw caps R ¾" with connecting ports	VER 0500	VER 0500
– 2 screw caps R 1" with connecting ports	VER 1500	VER 1500
– 2 screw caps R 1½" with connecting ports	VER 2500	VER 2500

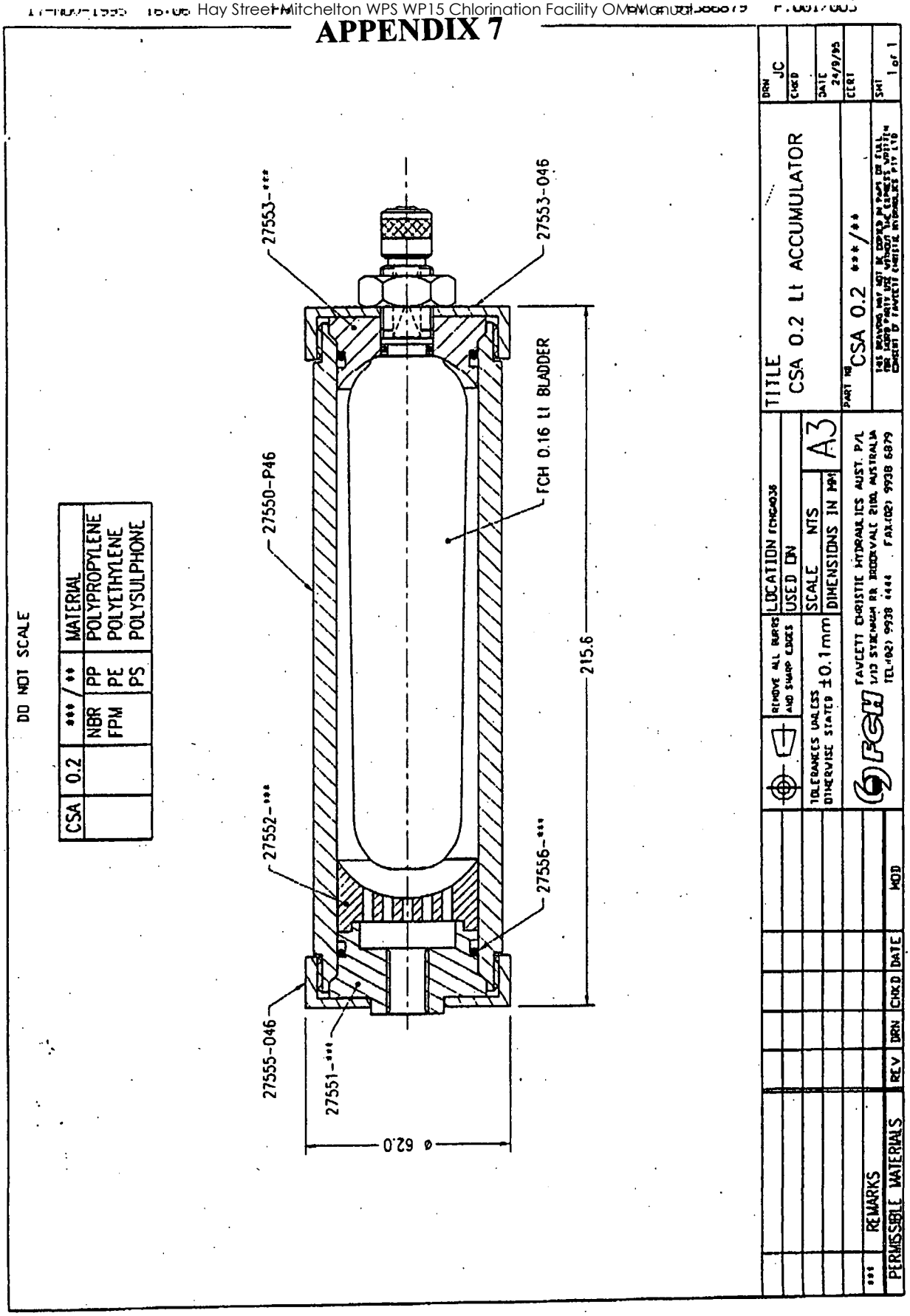
Materials

Measuring Tube	Polysulfon
Float	PVDF
O-Rings	Ethylene propylene (EPDM)
Screwed fittings	PVC

Technical Data

Max. operating pressure	PN 10
Operating temperature	up to + 100 Deg C max.
Accuracy class 4	in accordance with VDE/VDI 3513 part 2
Special scales	on request at extra cost.

APPENDIX 7


DO NOT SCALE
CSA 0.2 ***/**
NBR PP POLYPROPYLENE
FPM PE POLYETHYLENE
PS POLYSULPHONE
27553-***
27553-046
27550-P46
FCH 0.16 LI BLADDER
215.6
27552-***
27556-***
27555-046
27551-***
ø 62.0
TITLE
CSA 0.2 LI ACCUMULATOR
PART NO CSA 0.2 ***/**
SCALE NTS
A3
DIMENSIONS IN mm
TOLERANCES UNLESS OTHERWISE STATED ±0.1mm
REMOVE ALL BURRS AND SHARP EDGES
LOCATION FCH4038
USED ON
FAVELLE CHRISTIE HYDRAULICS AUST. P/L
DRN JC
CHKD
DATE 24/8/95
SHT 1 of 1
REMARKS
PERMISSIBLE MATERIALS
REV DRN CHKD DATE MOD

Appendix 8

Material Safety Data Sheets - MSDS

elite

Elite Chemicals Pty. Ltd. A.C.N. 009 985 326

POSTAL ADDRESS:
P.O. Box 8022, Wynnum North, Qld. 4178
1873 Lytton Road, Lytton, Brisbane, Qld. 4178

Telephone: (07) 3393 3222
Facsimile: (07) 3893 1219
E-Mail: eliteche@powerup.com.au

Quality Endorsed Company
Licence No. QEC 0460
ISO 9002-1994

APPENDIX 8

MATERIAL SAFETY DATA SHEET

Date of Issue: 16th September 1998 Revision: 0 Page: 1 of 2

Non Hazardous According to Criteria of Worksafe Australia

Product Name: **AMMONIUM SULPHATE SOLUTION 10%**

Use: Water treatment agent

Appearance: Clear Liquid

Boiling Point: 100°C

Vapour Pressure: N/A

Specific Gravity: 1.04 – 1.06

Solubility: Miscible with water

Flammability Limits: N/A

U.N. Number: None Assigned

Dangerous Goods Class: None Assigned

Secondary Risk: None Assigned

Pack Group: None Assigned

Poisons Schedule: None Assigned

pH: 5.0 – 6.0

Chemical Entity	C.A.S. Number	Proportion
Sulfate of Ammonia	7783-20-2	10%
Water	7732-18-5	to 100 %

HEALTH HAZARD INFORMATION

HEALTH EFFECTS – ACUTE

Swallowed : May result in nausea, vomiting and diarrhoea.

Eye: May cause irritation and inflammation.

Skin: Prolonged or repeated exposure may cause irritation.

Inhaled: No harmful vapour produced. Inhalation of mist may use respiratory tract irritation.

HEALTH EFFECTS – CHRONIC

No information available for this product.

MATERIAL SAFETY DATA SHEET

Date of Issue: 16th September 1998 Revision: 0

AMMONIUM SULPHATE SOLUTION 10%

FIRST AID

Swallowed : Rinse mouth with water. If swallowed do NOT induce vomiting. Give a glass of water. Seek Medical Advice.

Eye: Flood eyes with clean water for at least 15 minutes- retract eyelids often . Seek Medical Advice.

Skin: Remove all contaminated clothing including footwear. Wash affected areas thoroughly with mild soap And water. Thoroughly wash contaminated clothing before reuse. If irritation persists seek medical advice.

Inhaled: Remove from contaminated area immediately; avoid becoming a casualty. If NOT breathing apply artificial resuscitation.

FIRST AID FACITLITIES: Use should be made of an on-site approved first aid kit if required in the first instance until medical assistance is forthcoming.

ADICE TO DOCTOR: Treat symptomatically. Show this Material Safety Data Sheet to the medical practitioner.

PRECAUTIONS FOR USE

Exposure Standard: Ammonium Sulphate Oral LD50 (rat): 2840 mg/kg and Oral Lowest Toxic Dose (human): 1500 mg/kg

Engineering Controls: Engineering control to reduce exposure hazards are preferred.

Personal Protection: Ensure an eye bath and safety shower are available. Wash contaminated clothing before re-use. Operators are recommended to wear clothing including footwear. Operators are to ensure the use of occupational work hygiene.

Flammability: Material is non-flammable.

SAFE HANDLING INFORMATION

Storage and Transport: Transport or store in a dry place, away from food stuffs, oxidising agents, combustible materials and always ensure container is closed when not in use.

Spills and Disposal: Contain spill with absorbent. Avoid spill from entering drains or water courses. Remove for disposal in accordance with Local Waste Management. Flush area with excess water.

Fire and Explosion Hazard: Non flammable. Decomposes on heating emitting toxic fumes.

Extinguishing Media: Water may be effective for cooling containers. Deluge with water. Evacuate area move upwind of fire. Fire fighters to wear self-contained breathing apparatus.

OTHER INFORMATION

Do NOT mix with any other chemicals without reference to the manufacture.

Disclaimer: All information given in this data sheet and by the company's technical staff is compiled from the best information currently available. The company accepts no responsibility whatsoever for its accuracy or for any results which may be obtained by customers. Any customer who relies upon any advice or information given in this data sheet by the company or by its technical staff does so entirely at its own risk, and the company will not be liable for any loss or damage thereby suffered notwithstanding any want of care on the part of the company or its staff in compiling or giving advice or information.

Contact Point:

Compiled by : _____
Michael Carlson
Chief Chemist

Approved by: _____
Doug Cowell
Marketing Director

Ref: Ammonium Sulphate Solution 10%

elite
Elite Chemicals Pty. Ltd. A.C.N. 009 985 326

POSTAL ADDRESS:
P.O. Box 8022, Wynnum North, Qld. 4178
1873 Lytton Road, Lytton, Brisbane, Qld. 4178

Telephone: (07) 3393 3222
Facsimile: (07) 3893 1219
E-Mail: eliteche@powerup.com.au

Quality Endorsed Company
Licence No. QEC 0460
ISO 9002-1994

APPENDIX 8

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: SODIUM HYPOCHLORITE SOLUTION 10%

Issue Date: 06/97
Revision: 3

IDENTIFICATION

Product Name: SODIUM HYPOCHLORITE SOLUTION 10%

Other Names:

Product Code: 10785000

Use: Universal Disinfectant Bleach, Pool Chlorination.

Flashpoint: Nil

UN Number: 1791

Physical Description: Clear Yellow Liquid Hypochlorite Odour (Chlorine-like)

Boiling Point: 100 °C

Hazchem Code: 2R

Solubility in Water: Totally Miscible

Flammability Limits:
Upper %
Lower %

Dangerous Goods Class and Sub-Class: Class 8 (Alkali)

Specific Gravity: 1.140 - 1.160 @ 20°C

Vapour Pressure: Not Applicable

Poison Schedule: 5 (Warning)

pH: 12.2 - 13.2 @ 20°C

Other Properties:

Chemical Entity	Cas Number	Proportion
SODIUM HYPOCHLORITE	7681-52-9	10.0 - 10.8% w/v
SODIUM CHLORIDE	7647-14-5	8.0 - 9.0% w/v
SODIUM HYDROXIDE	1310-73-2	0.5 - 1.0% w/v
WATER	7732-18-5	TO 100%

HEALTH HAZARD INFORMATION

FIRST AID — **If poisoning occurs contact a doctor or Poisons Information Centre.**

Swallowed: DO NOT induce vomiting. If vomiting occurs give water to drink. Seek medical advice.

Eye: Irrigate continuously with water for 15 minutes. Seek medical advice.

Skin: Wash contaminated skin with water. Remove contaminated clothing and wash before re-use. Seek medical assistance.

Inhaled: Remove source of contamination. Remove victim if overcome to fresh air. Seek medical assistance

First Aid Facilities: Use should be made of an on-site approved first aid kit if required in the first instance until medical assistance is forthcoming.

Advice to Doctor: Treat symptomatically. Show this M.S.D.S. to the medical practitioner.

ADELAIDE: 5 North Terrace, Wingfield 5013, Phone: (08) 8347 0884, Fax: (08) 8268 9833
WOOLOONGONG: Lot 4 York Road, Bellambi 2518, Phone: (02) 4284 8155, Fax: (02) 4283 1783
TOWNSVILLE: 20 Dillane Street, Hyde Park 4812, Phone: (07) 4772 6777, Fax: (07) 4772 6844
ROCKHAMPTON: Cnr East and Stanley Sts, South Rockhampton 4700, Phone: (07) 4926 2282, Fax: (07) 4927 4386
COFFS HARBOUR: 16 Lawson Crescent, Coffs Harbour 2450, Phone: (02) 6652 7613, Fax: (02) 6652 7688
CAIRNS: 8 Knight Street, Portsmith 4870, Phone: 1800 819 753, Fax: (07) 4036 1555

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: SODIUM HYPOCHLORITE SOLUTION 10%

Issue Date: 06/97
Revision: 3

HEALTH HAZARD INFORMATION Cont.

HEALTH EFFECTS

Acute

Swallowed: Irritating to mucous membranes. May lead to oesophageal or gastric perforation. May lead to laryngeal edema.

Eye: Severe irritant. Prolonged contact with eyes may result in permanent injury.

Skin: Moderate irritant. Prolonged contact may result in a burn and may lead to dermatitis.

Inhale: Inhalation may cause respiratory irritation

Chronic: Prolonged contact with skin may cause dermatitis.

PRECAUTIONS FOR USE

Exposure Standard: Chlorine: 1.0 ppm Sodium Hypochlorite solution 10% decomposes to chlorine only after strong acidification. Under normal conditions no hazardous decomposition products are released and no exposure standards are assigned by the N.H. & M.R.C.

Engineering Controls: Engineering controls to reduce exposure hazards are preferred.

Personal Protection: Avoid skin and eye contact with the use of rubber gloves and safety glasses/goggles. Use good occupational work practice, wash hands after use.

Flammability: Non combustible material.

SAFE HANDLING INFORMATION

Storage and Transport: Classified as a dangerous good. Store in a cool area away from direct sunlight. Store containers upright. Keep lid closed when not in use. Store away from acids, combustible materials and dangerous goods. Transport in accordance with the A.D.G. code.

Spills and Disposal: Wear full protective equipment to prevent skin and eye contamination. Contain large spills with sand or absorbent, flush area with excess water. Remove in accordance with local waste management.

Fire/Explosion Hazard: Under conditions whereby contamination by metals has occurred, oxygen release may cause pressure build-up in containers without vented lids. Heating of such containers could cause expansion and possible rupture.

OTHER INFORMATION

DO NOT MIX WITH OTHER CHEMICALS WITHOUT PRIOR CONSULTATION WITH THE MANUFACTURER. Always use product as directed. Never return any unused material to original drum.

Disclaimer: All information given in this data sheet and by the company's technical staff is compiled from the best information currently available. The company accepts no responsibility whatsoever for its accuracy or for any results which may be obtained by customers. Any customer who relies upon any advice or information given in this data sheet by the company or by its technical staff does so entirely at its own risk, and the company will not be liable for any loss or damage thereby suffered notwithstanding any want of care on the part of the company or its staff in compiling or giving advice or information.

CONTACT POINT:

Compiled By: M Carlson

M. Carlson (Mr)
SENIOR CHEMIST

Approved By:

D. Cowell
MARKETING DIRECTOR

Ref: SODHYPO10.MSDS

Appendix 9

Engineering Drawings - Building & Schematic

DRAWING NO.	Rev	TITLE
486/4/7-JQ001	O	Cover Sheet and Drawing List
486/4/7-JQ002	B	Process and Instrumentation Diagram
486/4/7-JQ003	A	Distribution Board S.L.D. and Motor Control Centre General Arrangement
486/4/7-JQ004	A	Power and Control Schematic Diagram
486/4/7-JQ005	A	Chloramination PLC Analog Input Module Termination Diagram
486/4/7-JQ006	A	Chloramination PLC Analog Input Module Termination Diagram
486/4/7-JQ007	A	Chloramination PLC Analog Input Module Termination Diagram
486/4/7-JQ011	A	Relocatable Chloramination Building Site and Locality Plans
486/4/7-JQ012	B	Relocatable Chloramination Building General Arrangement
486/4/7-JQ013	O	Relocatable Chloramination Building Foundation Details
17357_01	AC	Face Sheet
17357_02	AC	First Course Plan - *as constructed*
17357_03	AC	Footing Details - *unchanged*
17357_04	AC	Architectural Elevation 'A' - *as constructed*
17357_05	AC	Architectural Elevation 'B' and 'D' - *unchanged*
17357_06	AC	Architectural Elevation 'D' - *unchanged*
17357_07	AC	Typical Cross Section and Roof Details - *unchanged*
17357_08	AC	Door Details - *unchanged*
17357_09	AC	Structural (Shop Detail) Elevation 'A' - *unchanged*
17357_010	AC	Structural (Shop Detail) Elevation 'B' and 'D' - *unchanged*
17357_011	AC	Structural (Shop Detail) Elevation 'C' - *unchanged*
17357_011A	AC	Structural (Shop Detail) Elevation 'E' and 'F' - *unchanged*
17357_012	AC	Internal Layout Plan - *unchanged*
17357_013	AC	Internal Elevation 'A' - *as constructed*
17357_014	AC	Internal Elevation 'B' and 'D' - *as constructed*
17357_015	AC	Internal Elevation 'C' - as constructed
17357_016	AC	Reflected Ceiling Plan - as constructed

Appendix 10

Post Project Review

APPENDIX 10

Brisbane City

BUSINESS ASSET SERVICES
PROJECT MANAGEMENT

Project Quality Officer, Greg Wenck 340 30270
Facsimile Machine 340 30271

Brisbane Water

MEMORANDUM

TO: Andrew Schoenmaker
FROM: Greg Wenck
DATE: 22 September 1998
SUBJECT: **Post Project Review of Hay Street Chloramination, Proj NO: RAZ.**

In reference to our earlier discussion and the subsequent meetings to discuss applicable corrective actions, the following is a list of findings made by Bruce Thompson and myself concerning the conformance and serviceability of the Hay street Chloramination plant with appropriate recommendations and the subsequent corrective actions for that project. (These are highlighted in a ***italics and bold*** font)

1. Drawings supplied by the manufacturer (Barrier Engineering & Construction) don't reflect as constructed drawings and appropriate document control. For example:

   - Dwg 17357-1. Cover page does not indicate the revision/amendment status of the attached 17 drawings.

   - Dwg 17357-2. Two extra holes were drilled into the floor slab but these are not shown on the drawings. It appears that the two original holes are unsuitable. This was not the manufacturers problem, but the team who drilled the holes and installed the works, and this was not updated.

   - Dwg 17357-4. A water tap is not shown. Secondly the present water tap is fitted too close to the door and needs to be shifted 500mm further away from the door for the Roles Street project. (*This is because the present tap position is damaging the skin of the door whenever the door is opened*). This also is not the manufacturers problem but the team who installed the tap.

   - Dwg 17357-13. The narrow and wide door are fitted the opposite (wrong) way; and secondly the 600mm height for the epoxy coating is incorrect. It actually covers the height of the complete wall.

   - Dwg 17357-14. 600mm and 1900mm height for the epoxy coating on the wall is also inaccurate. The epoxy coating is applied to the whole wall from floor to ceiling.

   - Dwg 17357-15. 1900mm height for the epoxy coating on the walls is also inaccurate. The epoxy coating is applied to the whole wall from floor to ceiling.

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- Dwg 17357-16. The electrical conduits are in the wrong position for the ceiling fans and lights to the switches.

Note: I have made the necessary changes in red ink on the original drawings and they will be copied and transferred into the proposed O&M Manual.

The above comments are made so that we can prevent these oversights in future as further corrective action on this project is not required.

2. Some as constructed drawings submitted by the installation team to the office are different from those as constructed drawings held in the plant room - even though the same drawing number and amendment NO are given. The problem is, the as constructed drawings in the plant room are a later amendment suitable for maintenance crews but the amendment status has not been updated.

   In conclusion, it was identified that the initial marked as constructed drawings were sent out for comment and these were given to the plan room by the contractor. Unbeknown that a final clean version of the "as constructed drawings" were made (not identified with an updated amendment NO) and never given to the plan room but sent out to site in the absence of any operation and maintenance manuals. The future process to prevent recurrence of the above problem is for all final "as constructed drawings" to be submitted to the construction manager and for him/her to arrange the necessary distribution. This distribution will occur through the O&M Manuals also.

   The corrective neasure has been arranged with Bruce Thompson who has supplied the updated drawings.

3. Dwg 486/4/7-JQO13 is not an as constructed drawing. This drawing is civil task and was apparently carried out by CAMs (Metro). We need to follow up for future projects as this is a repeat of a recent project when as constructed drawings are not updated, marked and issued.

   No action to be taken.

4. The lids of both 1500 litre tanks were not fitted and just left to the side on top of each tank. There is a concern on this unusual practice and one has to challenge whether the vent pipe fitted from each tank to their adjacent external wall have any purpose? Clarification is required very soon so that this can be incorporated into the procedures/ O&M Manuals.

   Later discussions with Bruce Thompson indicate that it is a design requirement for the lids to be fitted at all times. (I have informed Len Doherty of the problem and he will follow through with Bob Buckley on whether there is some reason for the removal of the lids and the corrective measure to prevent recurrence).

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5. Receipt dockets for the supply of both chemicals are just left in the plant room. This needs to be challenged and whether any financial audits/checks are carried out or linked backed to payments. Several of the receipt documents indicated that quantities of chemicals added to the tanks were different from what was ordered. In any case, I would expect that a process and procedure is written up by the maintenance crews and how this is linked backed to finances/payment.

   I have informed Len Doherty and he has passed the info on to Bob Buckley for inhouse action.

6. There is no process to verify that the truck drivers who fill the two 1500 litre chemical tanks are complying with approved procedures or if there is approved procedures?

   We will address this action in the O&M Manual.

7. Six spread sheets were found covering: manual start up procedures, filling the hypochloride tank, filling the ammonia sulphate tank, ammonia sulphate dosing calibration and sodium hypochloride dosing calibration. These spread sheets have considerable impact. Some impacts include:

- Are these spreadsheets approved and if so by who? The spread sheets indicate no authority, author or approval.

- The spread sheets have considerable environmental and workplace health and safety implications but no records. If the six title headings are correct, then the document control (from an environmental and OHS perspective for these spreadsheets) is nonconforming and we lack any legal support if something does go wrong.

- There is no information filled out to validate that the appropriate process was carried out by who and when? Even though the spreadsheets have columns for filling out information.

- There is no document control and personnel will not know whether these checklists are obsolete, superseded or can be amended?

I will review and add to the O&M Manual.

8. I am concerned whether we have objective evidence that the chloramination plant is doing what it was intended to do. For example it appears that the objective is to ensure the appropriate level of chloramination (*ie 1.5mg/l and/or 2ppm of chloramine depending on the source of information*) is maintained, but at what point in the water distribution system is this checked?

   The issue is that we have equipment in the plant that is dosing/metering out the level of chemical based upon the flow of water but this appears to be only estimates and assumes that all measuring equipment is calibrated and highly accurate. It also assumes that the chemical is of the appropriate concentrate.

APPENDIX 10

What we appear to not have is some sample test just after dosing and before the reservoirs to ensure that an appropriate level of chloramination has been achieved. This will at least ensure or check that the metering equipment is working and calibrated as required and the project has some cut off point/expectation for delivery to the client.

I do not think the objective of this project (*from the construction managers perspective*) is to produce safe drinking water but to provide a facility which has the capability to provide chloramine levels to a certain requirement and then it will be up to the client/maintenance personnel to monitor and regulate the quantity for the various distribution areas, reservoirs piping etc.

Concerning the integrity of the chemicals, we appear to not have any information that the liquid chemicals supplied are of a certain concentrate. Are random checks/tests carried out? In any case, clarification of the project objective is required as there appears to be various feasibility studies, project delivery documents and amendments etc with conflicting informations.

Unless there is some clear cut guideline from a QA perspective, I believe some base measurement and/or laboratory test need to be taken soon after the output from the chloramination plant to ensure that project was built to satisfy the initial objective of Chloramine levels of 2ppm. After all, what is the main criteria or deliverable for this project? Until we do this, we technically have not objectively demonstrated that the plant has the capability to do what it was meant to do.

Andrew Schoenmaker has identified that testing is not required at this point. The unit has been operating in excess of 12 months. Andrew has had several discussions with Bob Phillips (Supervising Microbiologist) who has indicated that the regular test sampling in that period has indicated acceptable water quality which proves that the unit is operating effectively.

9. I am also concerned about the exhaust fans regarding their position and the inlet grill. When we opened up the doors to the plant, the fans were operating, but we could smell the residue vapours and this raises two issues (*minus the fact that the lids of the two containers were not fitted*), they are:

   - The size of the inlet vent in one door appears to be too small for the two fans. When one also considers that the vent is facing the adjacent building and receives no direct wind/air current, this inadequacy needs to be evaluated for the Roles Street project. The design of the two buildings and the positioning of the present vent may be actually causing a venturi effect which inhibits the flow of air into the plant room.

   - Are the vapours from the chemicals heavier than air. My understanding is that the chlorine gas is heavier than air and would be settling within the bund area. I believe, the position of the fans in the ceiling/roof and its direct alignment with the vent on the door is not effective or efficient for removing the chlorine gas in the bund area.

APPENDIX 10

I think this needs to be more carefully addressed for the Roles Street project and consideration to be taken whether to rework Hay Street.

No action will be taken for Hay Street.

10. The discharge line on both 1500 litre tanks are higher than the lower sight gauge level, hence the container cannot be totally drained for cleaning etc. (*Refer to photo*). This needs to be corrected for the Roles Street project. Need to decide whether to rework for Hay Street also.

    No action to be taken at this time for Hay Street.

11. The roof/gutter down pipe is unconnected to any piping at the base of the plant room, hence the whole area was swampy and the concrete area surrounding the downpipe covered with green moss. Does this need to be corrected for this project and taken into account for the Roles Street project.

    No immediate action to be taken.

12. The connection of electrical cables to the underneath of the floor slab has left a gap (*Refer to photo*) between the galvanised plate and the base of the slab. This is very poor from an OHS and maintenance perspective. The adjacent concrete block is also been eroded and this needs to be addressed.

    Action will be taken, see Andrew Schoenmaker.

13. The vent pipes fitted to the external wall were not correctly fitted. (Lacked sealant between the galvanised plate and the brick wall) hence rain can/has entered the fittings and weeping down the internal wall.

    Maintenace crew to repair/seal with a silicon sealant.

14. The overfill pipe and the sight gauge level have been not fitted at the appropriate point (*too low*) on the tank, hence the 1500 litre capacity has been reduced too just 1100 litres. This can have considerable impact on transport costs for the Hypo which is used in a very high proportion to the ammonium sulphate.

    Awaiting decision on the fitout for Roles Hill on whether tanks to be modified and transferred.

15. All things being equal, I am wondering on the methodology used of having two identical storage tank sizes, when their output/use are vastly different. I am considering the maintenance and transport costs for ensuring continual operation of the plant if a vehicle may have to come to the sight as much as every four days. This has implications for the Roles Street project.

    No action for Hay Street at this point in time.

APPENDIX 10

16. A nozzle on the main pump station piping, is leaking or left open and is eroding away the ground soil and making the top of the retaining wall very swampy before flowing down to the creek behind the pump station.

    I have contacted Len Doherty and he will arrange for the valve to be piped to the creek. Apparently this valve is to be left opened for maintenance purposes.

17. A fire extinguisher is not fitted within the chloramination plant room, only the main pump station where quick access is not available. It appears a fire extinguisher is required by legislation for each building.

    I have followed up with OHS Rep and one is required from an electrical enclosure perspective. This needs to be done immediately. Andrew Schoenmaker to arrange procurement and installation. Bruce Thompson to address the specs for Roles Hill for inclusion of a fire extinquisher.

18. The chemicals are slowly eating/dissolving/pealing the epoxy paint. (*Refer to photo for a sample.*) A decision needs to be made for the Roles street project whether this epoxy paint is satisfactory.

    No action to be taken. Apparently, their is no paint that can withstand the effects of HYPO for continued periods. Best remedy is to remove and clean painted surfaces as soon as a spills or leaks occur and leave drip trays under those areas prone to leaks and spills.

19. The shower has not been constructed as planned and required by the specifications (i.e. AS 3780-1994 para 5.4 (f)). At least two metres are required between the discharge/filling points for the chemicals and the showers. This raises an important issue from a QA perspective, in that no contractor whether it be an internal or external contractor has the right to change the specifications or drawing layout without formal approval. This formal approval must be through the construction manager who must liaise with the design manager and all outcomes documented and approved. Apparently, this is not an isolated problem.

    I will include in our QA methodology to rectify the communication issue concerning who can change the specifications for onsite activities. Concerning the position of the shower, I have been in contact with Jeff Foreman who has given approval to leave the shower as is. The main intent of the Act has been satisfied in that a shower and eye wash is serviceable and readily available.

20. MSDS - material safety data sheets were not installed in the building and this is contrary to OHS legislation.

    I will liaise with Elite chemicals and arrange for copies which will be then placed in the O&M Manual.

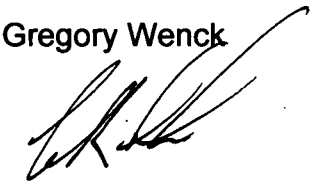
APPENDIX 10

21. A fan was not fitted to the electrical cabinet for external supply of air to pressurise the electrical cabinet in order to prevent corrosion from chemical vapours within the plant room. The specifications (part 5 page 2 of 37 clause 5.2.2 - 9th dot point and drawing 486-47/JQ003) have the installation of the fan as an essential requirement and this needs to be followed through.

Andrew schoenmaker to follow up and ensure the fan is installed.

Yours sincerely

Gregory Wenck

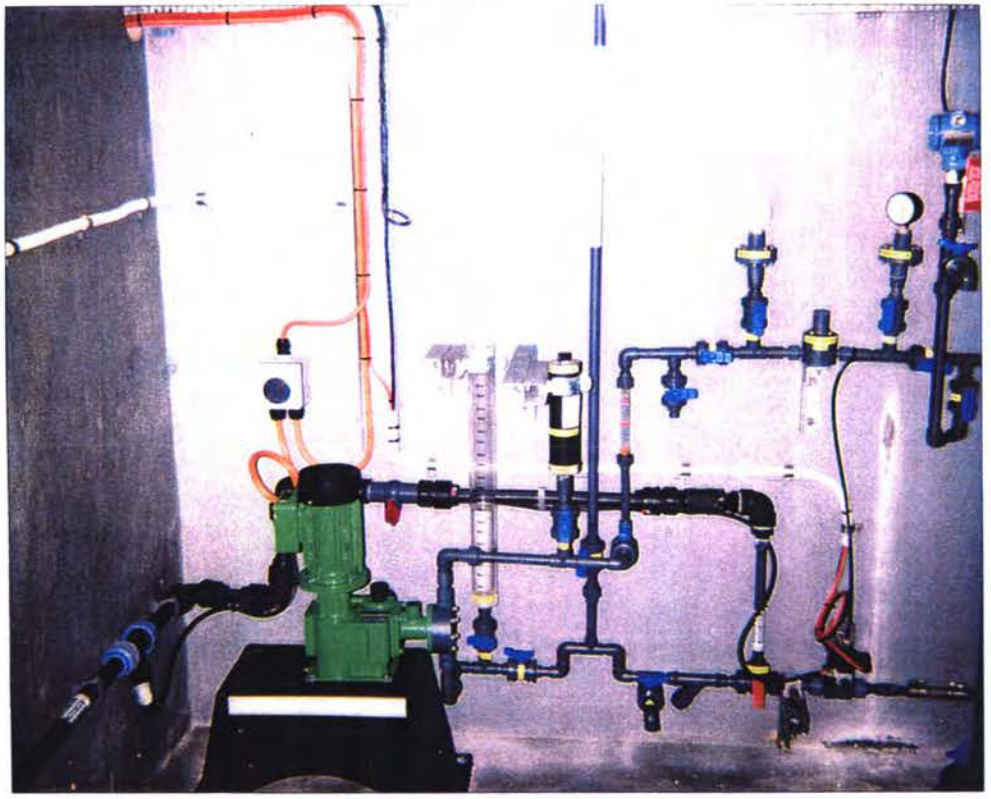


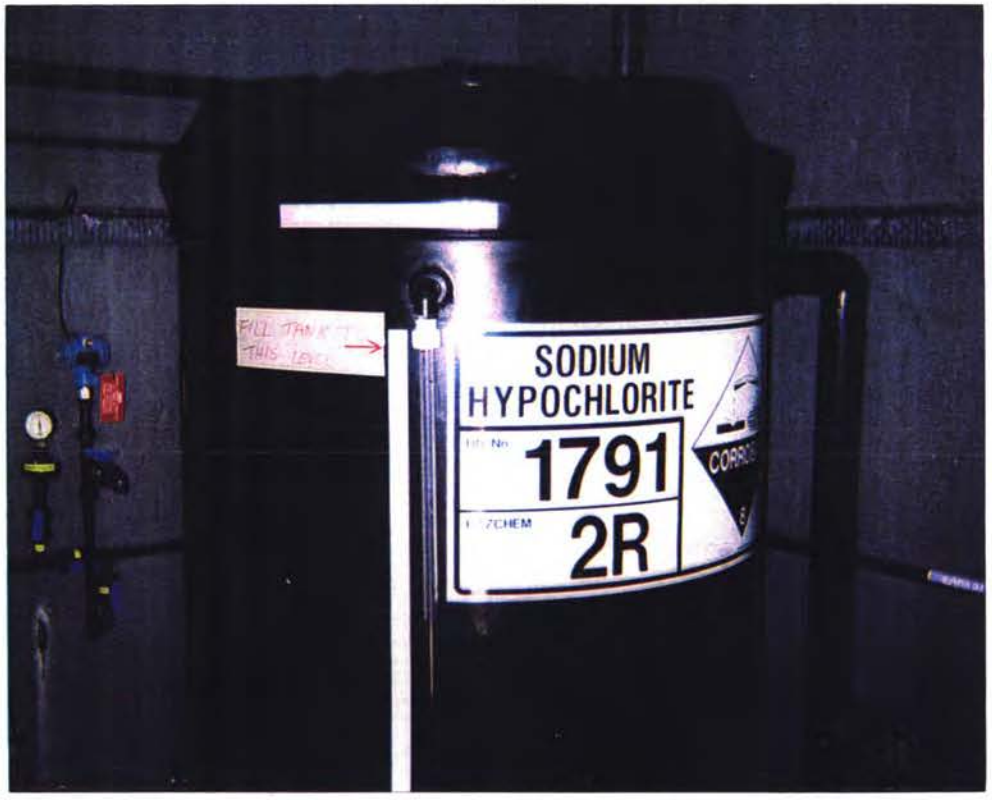
Appendix 11

Storage Tank and Plumbing Layout for Both Chemical Systems

APPENDIX 11

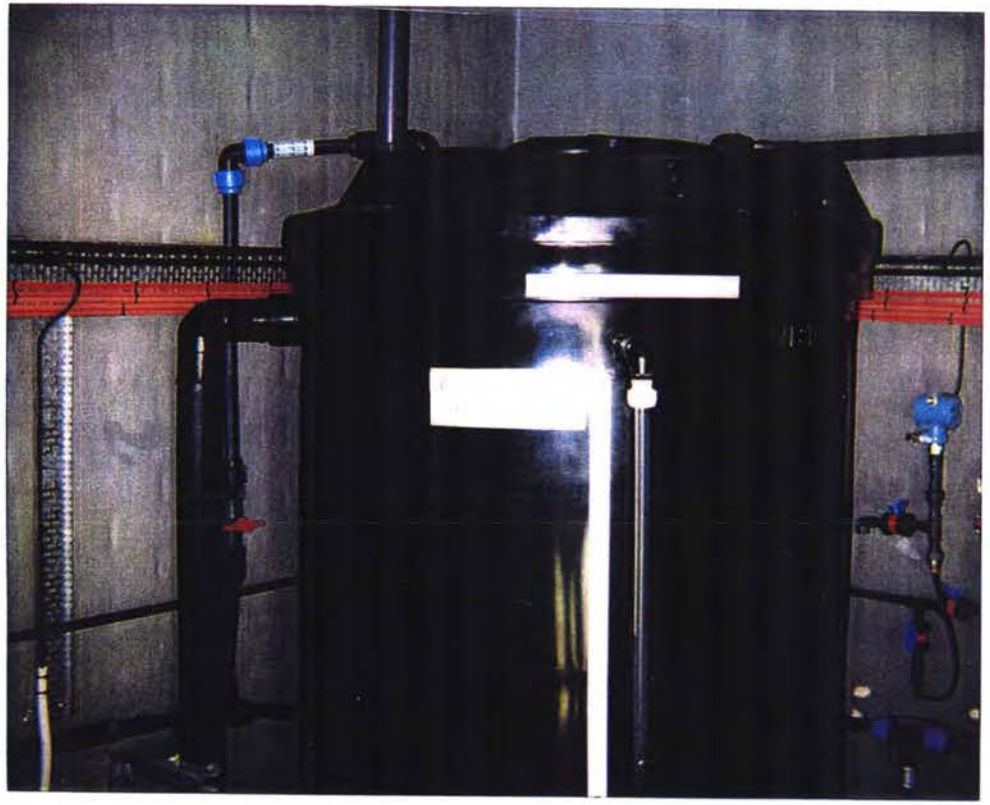
Chloramination Facilities at Hay Street - Sodium Hypochlorite System (24/08/98)

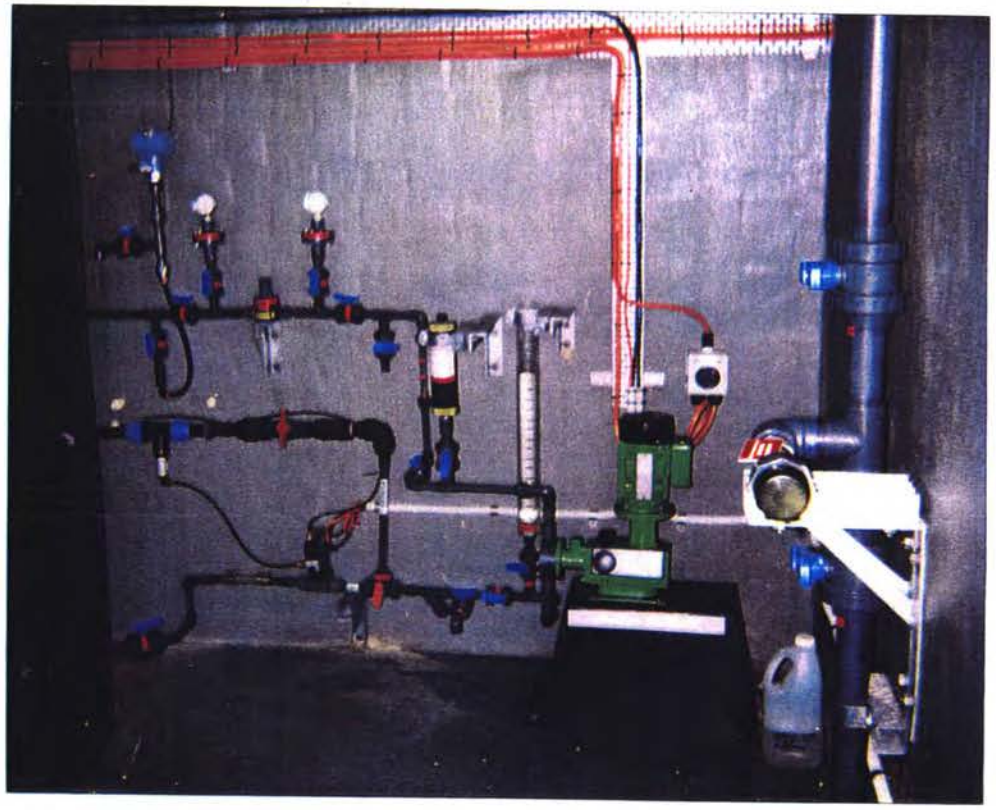




APPENDIX 11

Chloramination Facilities at Hay Street - Ammonia Sulphate System (24/08/98)





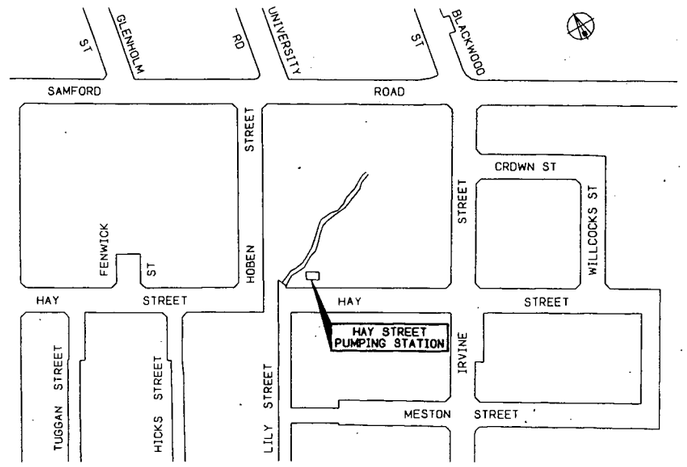
Brisbane City

Brisbane Water — Professional Services — Engineering

HAY STREET WATER PUMPING STATION

DRAWINGS FOR CHLORAMINATION FACILITY

DRAWING LIST	
DWG N°.	TITLE
486/4/7-JQ001	COVER SHEET AND DRAWING LIST
486/4/7-JQ002	PROCESS AND INSTRUMENTATION DIAGRAM
486/4/7-JQ003	DISTRIBUTION BOARD S.L.D. AND MOTOR CONTROL CENTRE GENERAL ARRANGEMENT
486/4/7-JQ004	POWER AND CONTROL SCHEMATIC DIAGRAM
486/4/7-JQ005	CHLORAMINATION PLC DIGITAL INPUT MODULE TERMINATION DIAGRAM
486/4/7-JQ006	CHLORAMINATION PLC DIGITAL OUTPUT MODULE TERMINATION DIAGRAM
486/4/7-JQ007	CHLORAMINATION PLC ANALOG INPUT MODULE TERMINATION DIAGRAM
486/4/7-JQ011	RELOCATABLE CHLORAMINATION BUILDING SITE AND LOCALITY PLANS
486/4/7-JQ012	RELOCATABLE CHLORAMINATION BUILDING GENERAL ARRANGEMENT
486/4/7-JQ013	RELOCATABLE CHLORAMINATION BUILDING FOUNDATION DETAILS



SITE PLAN
SCALE 1:2500

CADD FILE 47JQ001	SUPERVISING ENGINEER	
JOB FILE	N° 1 OF 1 SHEETS	
DRAWING N° 486/4/7-JQ001	AMEND. 0	

HAY STREET PUMPING STATION

DN.600 POTABLE TRUNK WATER MAIN

1 PUMP 360 L/S, 2 PUMPS 375 L/S

EXISTING FLOWMETER

DN.410 POTABLE TRUNK WATER MAIN

WITHDRAWABLE INJECTION QUILL

DO NOT CHANGE THE EXISTING STAINLESS STEEL NON-RETURN VALVE

DN.15 PVC 2-26 L/hr

DN.15 PVC 2-26 L/hr

WITHDRAWABLE INJECTION QUILL

CHLORAMINATION BUILDING

NB.50 VENT

VENT THROUGH SIDE WALL

10mm SMC PLASTIC TUBE TO SOLENOID VALVE

DN.40 PVC

NB.80 OVERFLOW

AMMONIUM SULPHATE STORAGE TANK 1500L

FILL KAMLOK

TANK VALVE

DN.25 PVC

DN.15 PVC

CALIBRATION TUBE

BUND LEVEL ALARM

BUND WALL

SODIUM HYPOCHLORITE STORAGE TANK 1500L

VENT NB.15 PVC

GAS TRAP U BEND

DN.32 MDPE POTABLE WATER

DN.32 MDPE

POTABLE WATER FROM RETICULATION MAIN

EMERGENCY SHOWER

EYEWASH

20mm OD COPPER

HOSE COCK

TRUCK HOSE DOWN COCK

LEGEND

- GENERAL VALVE
- BALL VALVE
- MULTI-PORT BALL VALVE
- ROTAMETER
- NON RETURN VALVE
- REDUCED PRESSURE ZONE DEVICE TO AS 2845
- PUMP
- PRESSURE RELIEF VALVE
- PRESSURE REGULATING VALVE
- FLEXIBLE COUPLING
- PULSATION DAMPENER
- STRAINER
- DIAPHRAGM
- BUCKET OR DRIP CATCH TRAY
- INTERLOCK
- PLC
- INSTRUMENT
- ACTUATOR (A)

ABREVIATIONS

LI	LEVEL INDICATION
LT	LEVEL TRANSMITTER
LA	LEVEL ALARM
LAL	LEVEL ALARM LOW
LALL	LEVEL ALARM LOW LOW
LAH	LEVEL ALARM HIGH
LAR	LEVEL ALARM RATE
LS	LEVEL SWITCH
PI	PRESSURE INDICATION
PT	PRESSURE TRANSMITTER
PAL	PRESSURE ALARM LOW
PAH	PRESSURE ALARM HIGH
FT	FLOW TRANSMITTER
FI	FLOW INDICATION
FAL	FLOW ALARM LOW
FRC	FLOW RATE CONTROL
SIC	SPEED INDICATION AND CONTROL

AS CONSTRUCTED

PLOTTED ..... DATE .....

CHECKED ..... DATE 14/9/98

NO.	DATE	AMENDMENT	INITALS
B	21.98	AS CONSTRUCTED ADDED	
A	16.7.97	FLEXIBLE COUPLING ADDED AND PRESSURE RELIEF CLARIFIED	J.V.D.W.

DIRECTOR OF P.D. & P.S. — DATE

ENGINEER IN CHARGE: ORIG. SIGNED R. BOWERING — DATE 29/5/95

SUPERVISING ENGINEER: ORIG. SIGNED M. HOLMES — RPEQ. NO. 5168 — DATE 28/5/97

	NAME	DATE
DESIGN	J.V.D.W.	APRIL97
DRAWN	I.G.B.	APRIL97
CH'KD.	J.V.D.W.	APRIL97

Brisbane City

JOB FILE (1)705/5(789)

CADD FILE 47JQ002

SURVEY NO. — FIELD BOOK —

SURVEYED — A.H. DATUM

Brisbane Water — Professional Services — Engineering

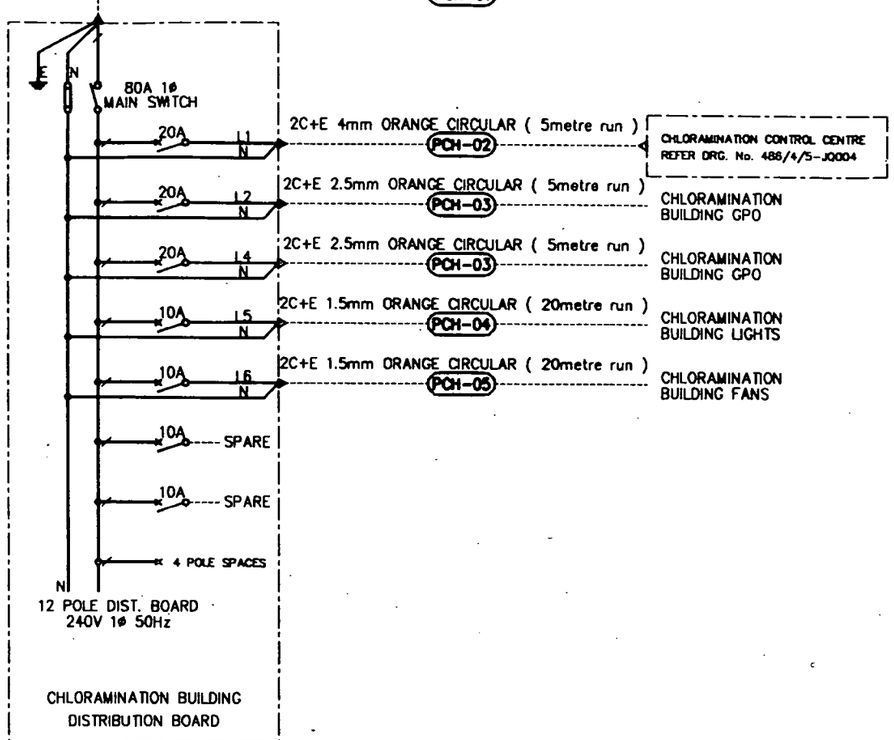
PROJECT
HAY STREET
WATER PUMPING STATION
CHLORAMINATION FACILITY

TITLE
PROCESS AND INSTRUMENTATION DIAGRAM

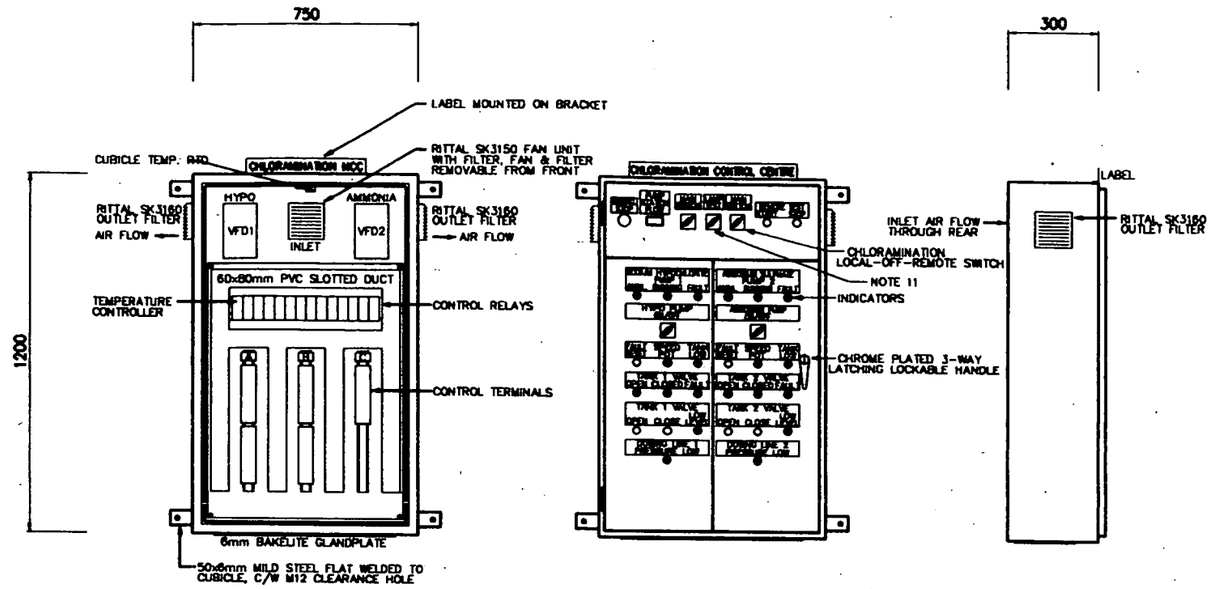
SCALE NOT TO SCALE — N° OF SHEETS

DRAWING N° 486/4/7-JQ002 — AMEND. B

CHLORAMINATION BUILDING
DISTRIBUTION BOARD S.L.D.



CHLORAMINATION BUILDING
MCC GENERAL ARRANGEMENT



INTERNAL LAYOUT
SCALE 1 : 10

FRONT DOOR LAYOUT

LEFT SIDE VIEW

NOTES

1. ALL 240Vac WIRING TO BE DOUBLE INSULATED.
2. ALL POWER CABLES TO BE CIRCULAR.
3. ALL 24Vdc WIRING SHALL BE SEGREGATED FROM 240Vac WIRING.
4. ALL MARSHALLING CUBICLE DIN RAIL TO BE STOOD OFF MOUNTING PANEL SO THAT THE FRONT FACE OF THE TERMINALS ARE 10mm BEHIND THE FRONT OF THE DUCT LID. DISCONNECT LEVEL TERMINALS SHALL BE 'KLIPPON' TYPE SAKR/35 WITH SOCKET SCREWS Cat No. 018336 DISCONNECT LEVER TERMINALS SHALL BE HINGED ON THE LEFT HAND SIDE. ALL TERMINALS SHALL BE NUMBERED USING 'KLIPPON' DEKAFIX TAGS.
5. CABLE ENTRY SHALL BE AT BOTTOM ONLY.
6. DIN RAIL TO BE 35mm ALUMINIUM PROFILE.
7. ALL WIRE NUMBERING SHALL BE GRAPHOPLAST WITH TRANSPARENT SLEEVES.
8. DUCTING TO BE 'IBOCO' SLOTTED DUCTSYSTEM (AVAILABLE FROM NHP).
9. FASTENERS TO BE 304 or 316 STAINLESS STEEL METRIC MACHINE SCREWS.
10. ALL LABELS TO BE FIXED WITH ADHESIVE TAPE AND M3 MACHINE SCREWS.
11. THE CHLORAMINATION CONTROL CENTRE LAMP TEST SWITCH SHALL HAVE THREE POSITIONS: OFF/NORMAL/TEST AND SHALL BE SPRING RETURN TO NORMAL FROM TEST.

AS CONSTRUCTED

NO.	DATE	AMENDMENT	INITIALS
A	8-1-98	AS CONSTRUCTED	RDM

DIRECTOR OF P.D. & P.S.		DATE
ENGINEER IN CHARGE	ORIGINAL SIGNED R. BOWRING	DATE 27-05-97
SUPERVISING ENGINEER	ORIGINAL SIGNED M. JUKES	R.P.E.Q. NO. 2632 DATE 27-05-97

	NAME	DATE
DESIGN	R.J.	02-05-97
DRAWN	RDM	13-05-97
CHECKED		
JOB FILE		
ACAD FILE	47JQ003	SHEET SIZE A1
SURVEY No.		FIELD BOOK
SURVEYED		A.H. DATUM

Brisbane Water

PROJECT
HAY STREET PUMP STATION
CHLORAMINATION PROJECT

TITLE
DISTRIBUTION BOARD S.L.D.
& MOTOR CONTROL CENTRE
GENERAL ARRANGEMENT.

SCALE 1 : 10	N° OF SHEETS
DRAWING N° 486/4/7-JQ003	AMEND. A

240VAC INCOMING SUPPLY FROM CHLORAMINATION BUILDING DISTRIBUTION BOARD REFER DRG. No. JQ003

MAIN SWITCH (Q1) 20A

FUJI VARIABLE FREQUENCY DRIVE FVR0.75E9S-7JE

HYPO DOSING PUMP LOCAL ISOLATOR

EMERGENCY STOP

HYPO DOSING PUMP (0.37kW) (DELTA CONNECTED)

1k OHM LOCAL SPEED POT.

PUMP 1 RESET

MAKE BEFORE BREAK BOTH POSITIONS

LOCAL / OFF / REMOTE

PART of SW. S1

250 OHM RESISTOR

4 - 20mA PLC OUTPUT (FUTURE)

AMMONIA DOSING PUMP LOCAL ISOLATOR

FUJI VARIABLE FREQUENCY DRIVE FVR0.75E9S-7JE

AMMONIA DOSING PUMP (0.37kW) (DELTA CONNECTED)

1k OHM LOCAL SPEED POT.

PUMP 2 RESET

240V AC TEMPERATURE CONTROLLER POWER SUPPLY (REFER DWG. JQ005)

HYPO DOSING PUMP 1

HYPO TANK OUTLET VALVE ACTUATOR SR1

SOLENOID VALVE No. 1.

PUMP 1 MAN SELECTOR OFF/ON S2

LOCAL / OFF / REMOTE

PUMP 1 MAN RUN RELAY 13, 13, 13

PUMP 1 AUTO RUN RELAY 13

PUMP 1 CONTROL POWER AVAILABLE RELAY 77

PUMP 1 VFD FAULT

PUMP 1 FAULT RELAY 13, 29

AMMONIA DOSING PUMP 2

PUMP 2 MAN SELECTOR OFF/ON S4

PUMP 2 MAN RUN RELAY 28, 28, 28

PUMP 2 AUTO RUN RELAY 28

PUMP 2 CONTROL POWER AVAILABLE RELAY 80

PUMP 1 VFD FAULT

PUMP 2 FAULT RELAY 28, 82

AMMONIA TANK OUTLET VALVE ACTUATOR SR2

SOLENOID VALVE No. 2.

NOTES

1. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE FOLLOWING DRAWINGS:- 486/4/7-JQ003, JQ005, JQ006, & JQ007
2. FVR 0.75E9S-7JE WILL BE FITTED WITH A RUN RELAY PART No. OPC-9-011A-E9

RTU DIGITAL INPUT SIGNALS REFER DRG. No. JQ005

- DOSING SYSTEM LOCAL CONTROL SELECTED
- DOSING SYSTEM REMOTE CONTROL SELECTED
- PUMP 1 CONTROL POWER AVAILABLE
- PUMP 1 RUNNING
- PUMP 1 FAULT
- PUMP 2 CONTROL POWER AVAILABLE
- PUMP 2 RUNNING
- PUMP 2 FAULT

RTU DIGITAL INPUT SIGNALS REFER DRG. No. JQ005

RTU DIGITAL OUTPUT SIGNALS REFER DRG. No. JQ006

- PUMP 1 AVAILABLE
- PUMP 1 RUNNING
- PUMP 1 FAULT
- PUMP 2 AVAILABLE
- PUMP 2 RUNNING
- PUMP 2 FAULT
- PUMP 1 RUN RELAY 55
- PUMP 2 RUN RELAY 85
- PUMPS 1 & 2 SPEED HIGH 13,28
- PUMPS 1 & 2 SPEED LOW 13,28
- PUMPS 1 & 2 RESET RELAY 13,28

RTU DIGITAL OUTPUT SIGNALS REFER DRG. No. JQ006

LEGEND

- RTU TERMINALS
- SWITCHBOARD TERMINAL
- VF DRIVE TERMINAL
- FIELD WIRING

AS CONSTRUCTED

A	6-1-98	AS CONSTRUCTED	RDM
ISS	DATE	AMENDMENT	INITIALS

DIRECTOR OF P.D. & P.S. — DATE

ENGINEER IN CHARGE — ORIGINAL SIGNED R. BOWRING — DATE 27-05-97

SUPERVISING ENGINEER — ORIGINAL SIGNED M. JUKES — R.P.E.Q. NO. 2832 — DATE 27-05-97

	NAME	DATE
DESIGN	R.J.	02-05-97
DRAWN	OLP	13-05-97
CHECKED		

Brisbane City

JOB FILE			
ACAD FILE	47JQ004	SHEET SIZE	A1
SURVEY No.		FIELD BOOK	
SURVEYED		A.H. DATUM	

Brisbane Water

PROJECT: HAY STREET PUMP STATION CHLORAMINATION PROJECT

TITLE: POWER & CONTROL SCHEMATIC DIAGRAM

SCALE	N.T.S.	N° OF SHEETS	
DRAWING N°	486/4/7-JQ004	AMEND.	A

CARD FRAME
SLOT 4 SLOT 5
PLB7 END PLATE PLB8
ROW B
FROM RTU EARTH BAR
FROM POWER TERMINAL INSIDE RTU
GND CON Bk 0+ 0- 1+ 1- 2+ 2- 3+ 3- 4+ 4- 5+ 5- 6+ 6- 7+ 7- 8+ 8- 9+ 9- 10+ 10- 11+ 11- 12+ 12- 13+ 13- 14+ 14- 15+ 15-
GN/YL DIM3+ RD DIM3- Bk
0+ DI3 (1W) 0- DI3 (1Bk) 1+ DI3 (2W) 1- DI3 (2Bk) 2+ DI3 (3W) 2- DI3 (3Bk) 3+ DI3 (4W) 3- DI3 (4Bk) 4+ DI3 (5W) 4- DI3 (5Bk) 5+ DI3 (6W) 5- DI3 (6Bk) 8+ DI3 (7W) 8- DI3 (7Bk) 7+ DI3 (8W) 7- DI3 (8Bk) 8+ DI3 (9W) 8- DI3 (9Bk) 9+ DI3 (10W) 9- DI3 (10Bk) 10+ DI3 (11W) 10- DI3 (11Bk) 11+ DI3 (12W) 11- DI3 (12Bk) 12+ DI3 (13W) 12- DI3 (13Bk) 13+ DI3 (14W) 13- DI3 (14Bk) 14+ DI3 (15W) 14- DI3 (15Bk) 15+ DI3 (16W) 15- DI3 (16Bk)
SPARES
NOTE 3
END PLATE & END BRACKET
20 PAIR, 30m CH-01
20 PAIR, 30m CH-02
HAY STREET PUMPING STATION MITS RTU (NOTE 2)

ROW A END PLATE
0+ DI3 (1W) 0- DI3 (1Bk) 1+ DI3 (2W) 1- DI3 (2Bk) 2+ DI3 (3W) 2- DI3 (3Bk) 3+ DI3 (4W) 3- DI3 (4Bk) 4+ DI3 (5W) 4- DI3 (5Bk) 5+ DI3 (6W) 5- DI3 (6Bk) 6+ DI3 (7W) 6- DI3 (7Bk) 7+ DI3 (8W) 7- DI3 (8Bk) 8+ DI3 (9W) 8- DI3 (9Bk) 9+ DI3 (10W) 9- DI3 (10Bk) 10+ DI3 (11W) 10- DI3 (11Bk) 11+ DI3 (12W) 11- DI3 (12Bk) 12+ DI3 (13W) 12- DI3 (13Bk) 13+ DI3 (14W) 13- DI3 (14Bk) 14+ DI3 (15W) 14- DI3 (15Bk) 15+ DI3 (16W) 15- DI3 (16Bk)
0+ DI4 (1W) 0- DI4 (1Bk) 1+ DI4 (2W) 1- DI4 (2Bk) 2+ DI4 (3W) 2- DI4 (3Bk) 3+ DI4 (4W) 3- DI4 (4Bk) 4+ DI4 (5W) 4- DI4 (5Bk) 5+ DI4 (6W) 5- DI4 (6Bk) 6+ DI4 (7W) 6- DI4 (7Bk) 7+ DI4 (8W) 7- DI4 (8Bk) 8+ DI4 (9W) 8- DI4 (9Bk)
SPARES
NOTE 4
END PLATE & END BRACKET
CHLORAMINATION CONTROL CENTRE

TEMPERATURE CONTROLLER
0+ DI3 8
0- DI3 7
1 2 3 RTD
5 4 10 11
A N
FAN
240V AC
REFER DWG. 486/4/7-JQ004

NORMAL OFF TEST
(W)1+DI3 1-DI3(Bk) CONTROL CENTRE LAMP TEST
(W)2+DI3 2-DI3(Bk)
LOCAL OFF REMOTE
(W)3+DI3 3-DI3(Bk) CONTROL CENTRE SEL SWITCH (S1)
(W)4+DI3 4-DI3(Bk)
(W)5+DI3 START 5-DI3(Bk) DOSING SYSTEM REMOTE START TEST
(W)6+DI3 STOP 6-DI3(Bk) DOSING SYSTEM REMOTE STOP TEST
(W)7+DI3 OPEN 7-DI3(Bk) HYPO TANK OUTLET VALVE OPEN
(W)8+DI3 CLOSE 8-DI3(Bk) HYPO TANK OUTLET VALVE CLOSE
(W)9+DI3 OPEN 9-DI3(Bk) AMMONIUM TANK OUTLET VALVE OPEN
(W)10+DI3 CLOSE 10-DI3(Bk) AMMONIUM TANK OUTLET VALVE CLOSE
(W)11+DI3 AV1-1 11-DI3(Bk) HYPO PUMP POWER AVAILABLE
(W)12+DI3 AX1 P1R AX2 12-DI3(Bk) HYPO PUMP RUNNING
(W)13+DI3 FR1-2 13-DI3(Bk) HYPO PUMP FAULT
(W)14+DI3 AV2-1 14-DI3(Bk) AMMONIA PUMP POWER AVAILABLE
(W)15+DI3 AX1 P2R AX2 15-DI3(Bk) AMMONIA PUMP RUNNING
(W)0+DI4 FR2-2 0-DI4(Bk) AMMONIA PUMP FAULT

2 PAIR, 10m CH-05
(W)1+DI4 OPEN 1-DI4(1Bk)
(2Bk)2+DI4 CLOSED 2-DI4(2Bk)
HYPO TANK OUTLET VALVE

2 PAIR, 10m CH-06
(1W) 3+DI4
(1Bk) 3-DI4 LS-01
HYPO BUND FLOAT SWITCH

(1W) 4+DI4 OPEN 4-DI4(1Bk)
(2W) 5+DI4 CLOSED 5-DI4(2Bk)
AMMONIA TANK OUTLET VALVE

2 PAIR, 10m CH-07

2 PAIR, 10m CH-08
(1W) 6+DI4
(1Bk) 6-DI4 LS-02
AMMONIA BUND FLOAT SWITCH

2 PAIR, 8m CH-09
(1W) 7+DI4
(1Bk) 7-DI4 LS-03
CHLORAMINATION BUILDING DOOR SWITCH

NOTES

1. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE FOLLOWING DRAWINGS:- 486/4/7-JQ003, JQ004, JQ006, JQ007
2. THE RTU CUBICLE IS AN EXISTING CUBICLE, AS PART OF THIS CONTRACT THE NEW TERMINALS SHALL BE INSTALLED, ON A NEW DIN RAIL.
3. THE RTU TERMINALS SHALL BE 'KLIPPON' ASK1 Cat No. 37685 FUSE OR LINK TERMINALS FITTED WITH 500mA FUSES.
4. THE CHLORAMINATION CONTROL CENTRE TERMINALS SHALL BE 'KLIPPON' SAK2.5/35.

NO	DATE	AMENDMENT	ROM INITIALS
A	14-1-98	AS CONSTRUCTED	

DIRECTOR OF P.D. & P.S. DATE
ENGINEER IN CHARGE ORIGINAL SIGNED R. BOWRING DATE 29-05-97
SUPERVISING ENGINEER ORIGINAL SIGNED M. JUKES R.P.E.Q. NO. 2632 DATE 27-05-97

	NAME	DATE
DESIGN	R.J.	02-05-97
DRAWN	OLP	13-05-97
CHECKED		

Brisbane City

JOB FILE			
ACAD FILE	47JQ005	SHEET SIZE	A1
SURVEY No.		FIELD BOOK	
SURVEYED		A.H. DATUM	

Brisbane Water

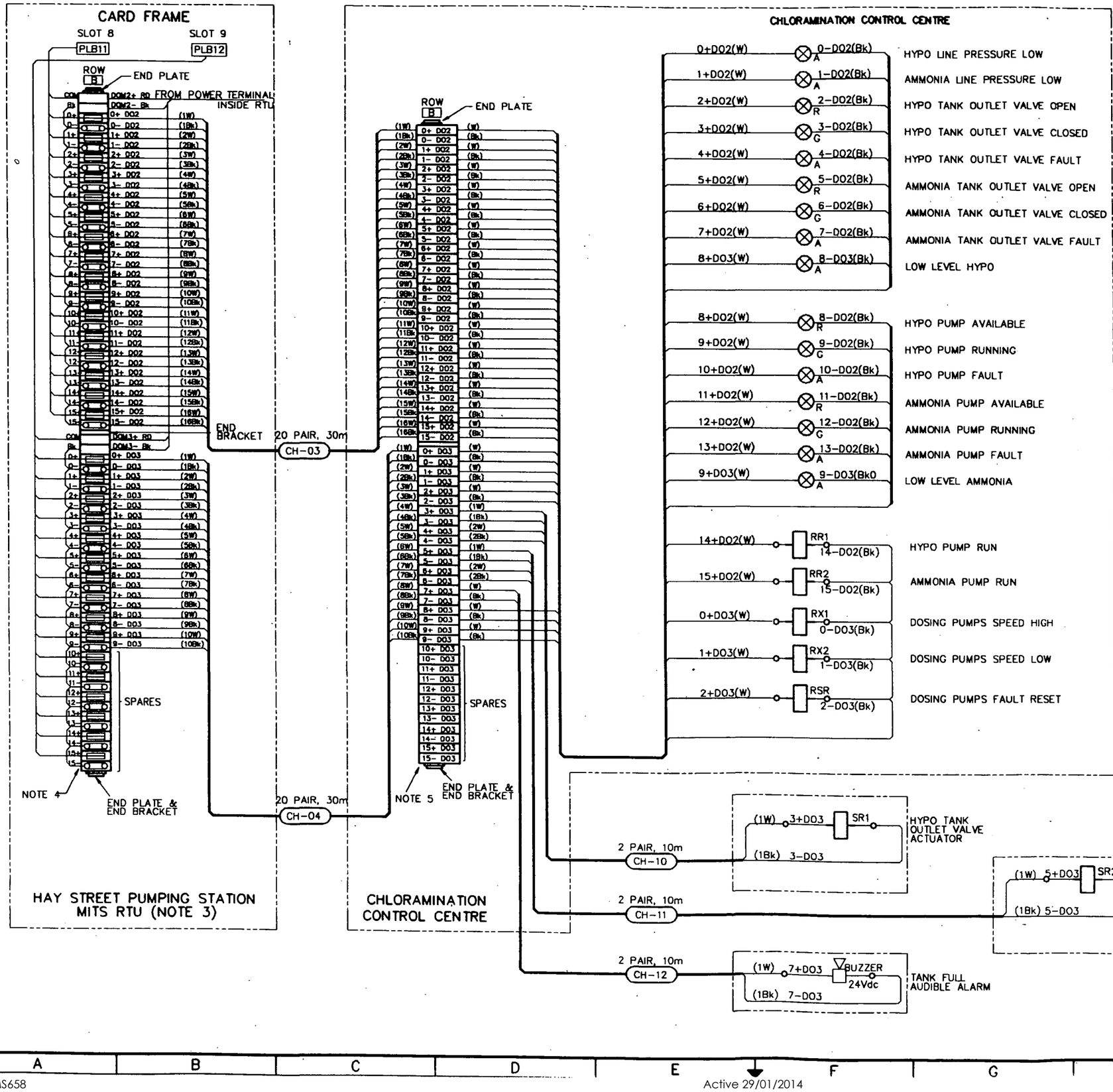
PROJECT
HAY STREET PUMP STATION CHLORAMINATION PROJECT

TITLE
CHLORAMINATION PLC DIGITAL INPUT MODULE TERMINATION DIAGRAM

SCALE N.T.S. SHEET OF SHEETS

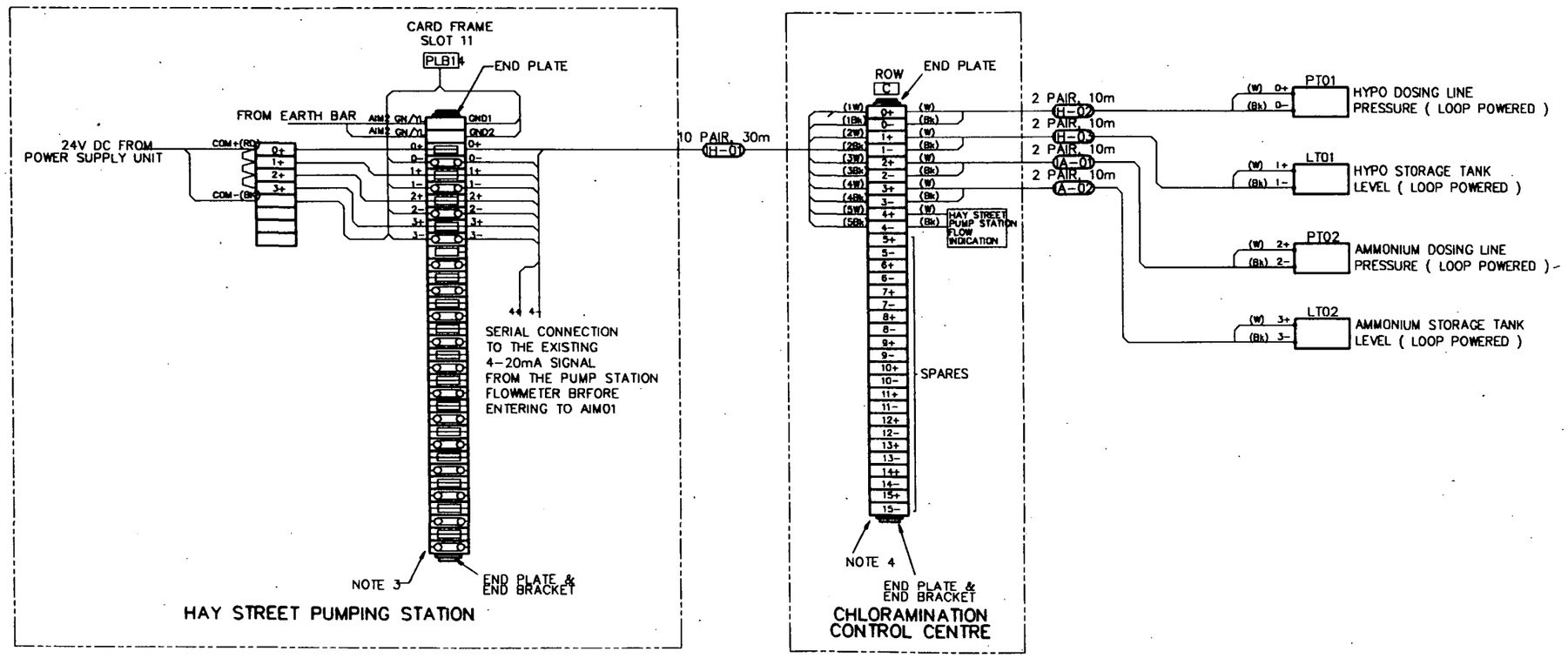
DRAWING No. 486/4/7-JQ005 AMEND. A

AS CONSTRUCTED


CARD FRAME
SLOT 8
PLB11
SLOT 9
PLB12
ROW B
END PLATE
FROM POWER TERMINAL INSIDE RTU
DOM2+ RD
DOM2- Bk
0+ DO2 (1W)
0- DO2 (1Bk)
1+ DO2 (2W)
1- DO2 (2Bk)
2+ DO2 (3W)
2- DO2 (3Bk)
3+ DO2 (4W)
3- DO2 (4Bk)
4+ DO2 (5W)
4- DO2 (5Bk)
5+ DO2 (6W)
5- DO2 (6Bk)
6+ DO2 (7W)
6- DO2 (7Bk)
7+ DO2 (8W)
7- DO2 (8Bk)
8+ DO2 (9W)
8- DO2 (9Bk)
9+ DO2 (10W)
9- DO2 (10Bk)
10+ DO2 (11W)
10- DO2 (11Bk)
11+ DO2 (12W)
11- DO2 (12Bk)
12+ DO2 (13W)
12- DO2 (13Bk)
13+ DO2 (14W)
13- DO2 (14Bk)
14+ DO2 (15W)
14- DO2 (15Bk)
15+ DO2 (16W)
15- DO2 (16Bk)
DOM3+ RD
DOM3- Bk
0+ DO3 (1W)
0- DO3 (1Bk)
1+ DO3 (2W)
1- DO3 (2Bk)
2+ DO3 (3W)
2- DO3 (3Bk)
3+ DO3 (4W)
3- DO3 (4Bk)
4+ DO3 (5W)
4- DO3 (5Bk)
5+ DO3 (6W)
5- DO3 (6Bk)
6+ DO3 (7W)
6- DO3 (7Bk)
7+ DO3 (8W)
7- DO3 (8Bk)
8+ DO3 (9W)
8- DO3 (9Bk)
9+ DO3 (10W)
9- DO3 (10Bk)
SPARES
END BRACKET
20 PAIR, 30m
CH-03
CH-04
NOTE 4
END PLATE & END BRACKET
HAY STREET PUMPING STATION MITS RTU (NOTE 3)
ROW B
END PLATE
0+ DO2 (W)
0- DO2 (Bk)
1+ DO2 (W)
1- DO2 (Bk)
2+ DO2 (W)
2- DO2 (Bk)
3+ DO2 (W)
3- DO2 (Bk)
4+ DO2 (W)
4- DO2 (Bk)
5+ DO2 (W)
5- DO2 (Bk)
6+ DO2 (W)
6- DO2 (Bk)
7+ DO2 (W)
7- DO2 (Bk)
8+ DO2 (W)
8- DO2 (Bk)
9+ DO2 (Bk)
9- DO2 (W)
10+ DO2 (Bk)
10- DO2 (W)
11+ DO2 (Bk)
11- DO2 (W)
12+ DO2 (Bk)
12- DO2 (Bk)
13+ DO2 (W)
13- DO2 (Bk)
14+ DO2 (Bk)
14- DO3 (W)
15+ DO2 (W)
15- DO3 (Bk)
0+ DO3 (W)
0- DO3 (Bk)
1+ DO3 (W)
1- DO3 (Bk)
2+ DO3 (W)
2- DO3 (Bk)
3+ DO3 (1W)
3- DO3 (1Bk)
4+ DO3 (2W)
4- DO3 (2Bk)
5+ DO3 (1W)
5- DO3 (1Bk)
6+ DO3 (2W)
6- DO3 (2Bk)
7+ DO3 (W)
7- DO3 (Bk)
8+ DO3 (W)
8- DO3 (Bk)
9+ DO3 (W)
9- DO3 (Bk)
10+ DO3
10- DO3
11+ DO3
11- DO3
12+ DO3
12- DO3
13+ DO3
13- DO3
14+ DO3
14- DO3
15+ DO3
15- DO3
SPARES
NOTE 5
END PLATE & END BRACKET
CHLORAMINATION CONTROL CENTRE
CHLORAMINATION CONTROL CENTRE
0+DO2(W) 0-DO2(Bk) A — HYPO LINE PRESSURE LOW
1+DO2(W) 1-DO2(Bk) A — AMMONIA LINE PRESSURE LOW
2+DO2(W) 2-DO2(Bk) R — HYPO TANK OUTLET VALVE OPEN
3+DO2(W) 3-DO2(Bk) G — HYPO TANK OUTLET VALVE CLOSED
4+DO2(W) 4-DO2(Bk) A — HYPO TANK OUTLET VALVE FAULT
5+DO2(W) 5-DO2(Bk) R — AMMONIA TANK OUTLET VALVE OPEN
6+DO2(W) 6-DO2(Bk) G — AMMONIA TANK OUTLET VALVE CLOSED
7+DO2(W) 7-DO2(Bk) A — AMMONIA TANK OUTLET VALVE FAULT
8+DO3(W) 8-DO3(Bk) A — LOW LEVEL HYPO
8+DO2(W) 8-DO2(Bk) R — HYPO PUMP AVAILABLE
9+DO2(W) 9-DO2(Bk) G — HYPO PUMP RUNNING
10+DO2(W) 10-DO2(Bk) A — HYPO PUMP FAULT
11+DO2(W) 11-DO2(Bk) R — AMMONIA PUMP AVAILABLE
12+DO2(W) 12-DO2(Bk) G — AMMONIA PUMP RUNNING
13+DO2(W) 13-DO2(Bk) A — AMMONIA PUMP FAULT
9+DO3(W) 9-DO3(Bk0 A — LOW LEVEL AMMONIA
14+DO2(W) RR1 14-DO2(Bk) — HYPO PUMP RUN
15+DO2(W) RR2 15-DO2(Bk) — AMMONIA PUMP RUN
0+DO3(W) RX1 0-DO3(Bk) — DOSING PUMPS SPEED HIGH
1+DO3(W) RX2 1-DO3(Bk) — DOSING PUMPS SPEED LOW
2+DO3(W) RSR 2-DO3(Bk) — DOSING PUMPS FAULT RESET
2 PAIR, 10m CH-10
(1W) 3+DO3 SR1
(1Bk) 3-DO3
HYPO TANK OUTLET VALVE ACTUATOR
2 PAIR, 10m CH-11
(1W) 5+DO3 SR2
(1Bk) 5-DO3
AMMONIA TANK OUTLET VALVE ACTUATOR
2 PAIR, 10m CH-12
(1W) 7+DO3 BUZZER 24Vdc
(1Bk) 7-DO3
TANK FULL AUDIBLE ALARM
NOTES
1. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE FOLLOWING DRAWINGS: - 486/4/7-JQ003, JQ004, JQ005, & JQ007.
2. USE INSULATED COMB
3. THE RTU CUBICLE IS AN EXISTING CUBICLE, AS PART OF THIS CONTRACT THE NEW TERMINALS SHALL BE INSTALLED, ON A NEW DIN RAIL.
4. THE RTU TERMINALS SHALL BE 'KLIPPON' ASK1 Cat No. 047456 FUSE OR LINK TERMINALS FITTED WITH 500mA FUSES.
5. THE CHLORAMINATION CONTROL CENTRE TERMINALS SHALL BE 'KLIPPON' SAK2.5/35.
A 12-1-98 AS CONSTRUCTED RDM
NO DATE AMENDMENT INITIALS
DIRECTOR OF P.D. & P.S. DATE
ENGINEER IN CHARGE ORIGINAL SIGNED R. BOWRING DATE 29-05-98
SUPERVISING ENGINEER ORIGINAL SIGNED R. BOWRING R.P.E.Q. NO. 2632 DATE 27-05-98
NAME DATE
DESIGN R.J. 02-05-97
DRAWN DLP 13-05-97
CHECKED
Brisbane City
JOB FILE
ACAD FILE 47JQ006 SHEET SIZE A1
SURVEY No. FIELD BOOK
SURVEYED A.H. DATUM
Brisbane Water
PROJECT
HAY STREET PUMP STATION CHLORAMINATION PROJECT
TITLE
CHLORAMINATION PLC DIGITAL OUTPUT MODULE TERMINATION DIAGRAM
SCALE N.T.S. N° OF SHEETS
DRAWING N° 486/4/7-JQ006 AMEND. A
AS CONSTRUCTED

NOTES

1. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE FOLLOWING DRAWINGS: - 486/4/7-JQ003, JQ004, JQ005, & JQ006
2. THE RTU CUBICLE IS AN EXISTING CUBICLE, AS PART OF THIS CONTRACT THE NEW TERMINALS SHALL BE INSTALLED, ON A NEW DIN RAIL.
3. THE RTU TERMINALS SHALL BE 'KLIPPON' ASK1 Cat No. 37686 FUSE OR LINK TERMINALS FITTED WITH 500mA FUSES.
4. THE CHLORAMINATION CONTROL CENTRE TERMINALS SHALL BE 'KLIPPON' SAK2.5/35.



NO	DATE	AMENDMENT	INITIALS
A	12-1-98	AS CONSTRUCTED	RDM

DIRECTOR OF P.D. & P.S.		DATE
ENGINEER IN CHARGE	ORIGINAL SIGNED R. BOWRING	DATE 29-05-98
SUPERVISING ENGINEER	ORIGINAL SIGNED M. JUKES	R.P.E.Q. NO. 2632 DATE 27-05-98

	NAME	DATE
DESIGN	R.J.	02-05-97
DRAWN	OLP	13-05-97
CHECKED		
JOB FILE		
ACAD FILE	47JQ007	SHEET SIZE A1
SURVEY No.		FIELD BOOK
SURVEYED		A.H. DATUM

Brisbane City

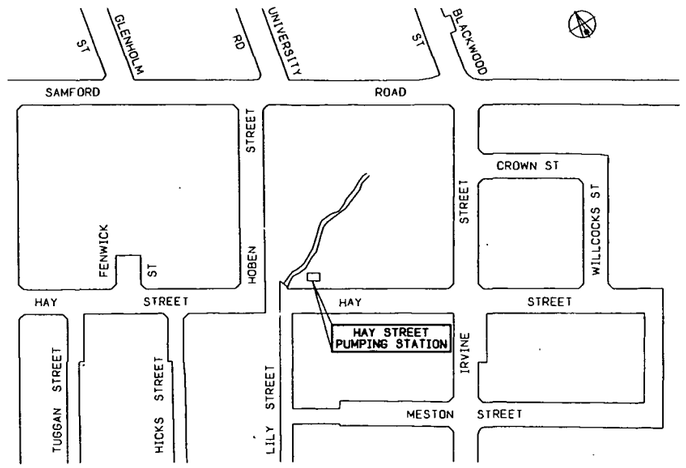
Brisbane Water

PROJECT
HAY STREET PUMP STATION
CHLORAMINATION PROJECT

TITLE
CHLORAMINATION PLC
ANALOG INPUT MODULE
TERMINATION DIAGRAM

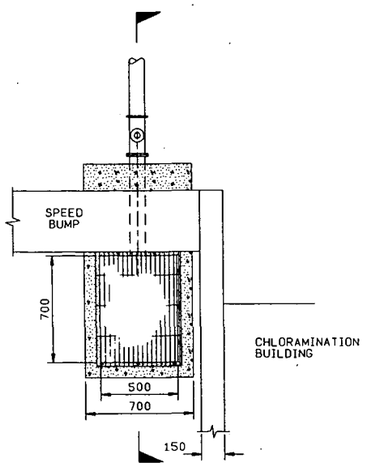
SCALE N.T.S.	N° OF SHEETS
DRAWING N° 486/4/7-JQ007	AMEND. A

AS CONSTRUCTED

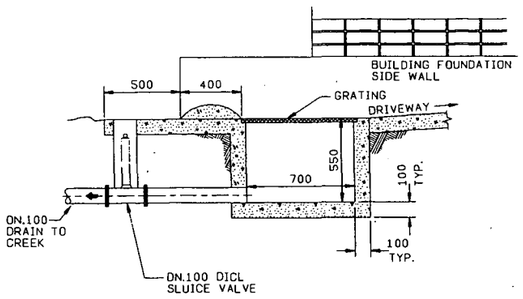


SITE PLAN

SCALE 1:2500



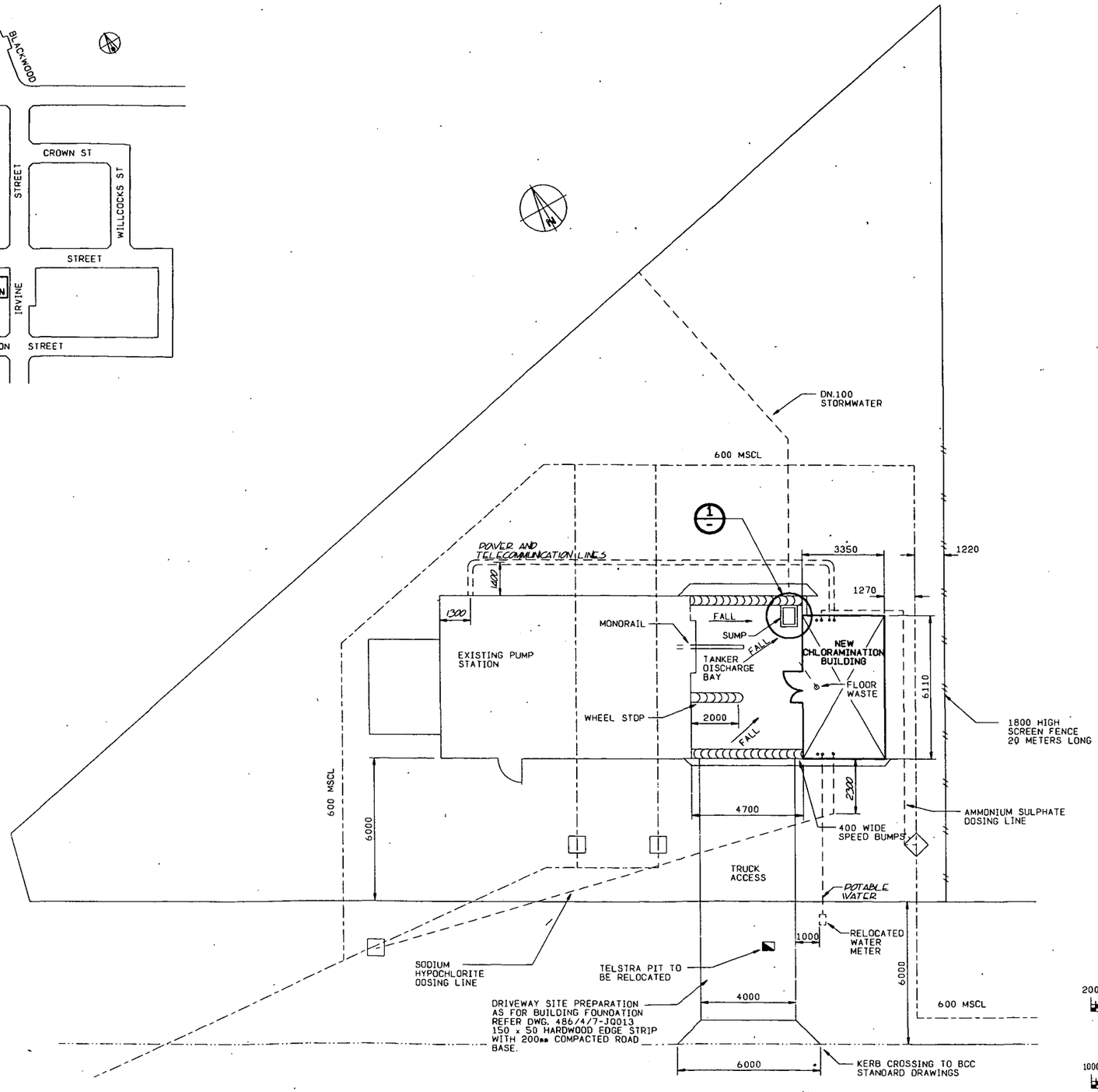
PLAN



SECTION

DETAIL 1 / –

SCALE 1:20



HAY STREET

LOCALITY PLAN

SCALE 1:100

200 0 200 400 600 800 1000
SCALE OF MILLIMETRES
1 : 20

1000 0 1000 2000 3000 4000 5000
SCALE OF MILLIMETRES
1 : 100

20 0 20 40 60 80 100
SCALE OF METRES
1 : 2500

AS CONSTRUCTED
PLOTTED 21/8/98 DATE
CHECKED DATE 4/9/98

DO NOT SCALE THIS DRAWING

ISSUED FOR TENDER PURPOSES ONLY

NO.	DATE	AMENDMENT	INITALS
A	20.1.98	AS CONSTRUCTED ADDED	

DIRECTOR OF P.D. & P.S. DATE
ENGINEER IN CHARGE ORIG. SIGNED R. BOWRING DATE 29.5.97
SUPERVISING ENGINEER ORIG. SIGNED L. DON RPEQ NO. DATE 28.5.97

	NAME	DATE
DESIGN	B.THOMPSON	MAY '97
DRAWN	JJV	MAY '97
CHK'D	KCI	MAY '97

Brisbane City

JOB FILE	
CADD FILE	47JQ011
SURVEY NO.	FIELD BOOK
SURVEYED	A.H. DATUM

Brisbane Water — Professional Services — Engineering

PROJECT
HAY STREET
WATER PUMPING STATION
CHLORAMINATION FACILITY

TITLE
RELOCATABLE CHLORAMINATION BUILDING
SITE AND LOCALITY PLANS

SCALE AS SHOWN | N° 1 OF 3 SHEETS
DRAWING N° 486/4/7-JQ011 | AMEND. A

5 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160

BRISBANE CITY COUNCIL

BRISBANE WATER CHEMICAL STORAGE

DRAWING No	REV	DESCRIPTION
17357_01	AC	FACE SHEET
17357_02	AC	FIRST COURSE PLAN – As Constructed
17357_03	AC	FOOTING DETAILS UNCHANGED
17357_04	AC	ARCHITECTURAL ELEVATION 'A'-As Constructed
17357_05	AC	ARCHITECTURAL ELEVATION 'B' and 'D' UNCHANGED
17357_06	AC	ARCHITECTURAL ELEVATION 'D' UNCHANGED
17357_07	AC	TYPICAL CROSS SECTION AND ROOF DETAILS UNCHANGED
17357_08	AC	DOOR DETAILS UNCHANGED
17357_09	AC	STRUCTURAL (SHOP DETAIL) ELEVATION 'A' UNCHANGED
17357_10	AC	STRUCTURAL (SHOP DETAIL) ELEVATION 'B' and 'D' UNCHANGED
17357_11	AC	STRUCTURAL (SHOP DETAIL) ELEVATION 'C' UNCHANGED
17357_11A	AC	STRUCTURAL (SHOP DETAIL) ELEVATION 'E' and 'F' UNCHANGED
17357_12	AC	INTERNAL LAYOUT PLAN UNCHANGED
17357_13	AC	INTERNAL ELEVATION 'A' As Constructed
17357_14	AC	INTERNAL ELEVATION 'B' and 'D' As Constructed
17357_15	AC	INTERNAL ELEVATION 'C' As Constructed
17357_16	AC	REFLECTED CEILING PLAN As Constructed

NOTE:- GENERAL

GENERAL:-

G1. THESE DRAWINGS ARE TO BE READ IN CONJUNCTION WITH

1. THE BUILDING CODE OF AUSTRALIA
2. DRAWINGS BY ALL OTHER RELEVANT THIRD PARTY SUPPLIERS INCLUDING:-

G2. THESE DRAWINGS SHALL NOT BE SCALED, ANY DISCREPANCY SHALL BE REPORTED TO BILL GAMBLE PROJECT CONSULTANTS P/L

G3. BEFORE CORING, DRILLING OR CUTTING INTO BRICKWORK, BARRIER ENGINEERING Pty. Ltd. TO BE CONSULTED TO ASCERTAIN IMPLICATIONS ON STRUCTURE PERFORMANCE

NOTES:- ENVIRONMENT / DESIGN RESTRICTIONS

FLOOR LOADINGS:-

F1. 5 kPa UNIFORMLY DISTRIBUTED
F2. - kN CONCENTRATED LOAD
F3. 15 kPa UNIFORMLY DISTRIBUTED UNDER TANKS

UNDER NO CIRCUMSTANCES SHOULD THESE LOADS BE EXCEEDED WITHOUT THE CONSENT OF THE DESIGN ENGINEER

WIND CATAGORY:-

W1. TERRAIN CATEGORY 2
WIND VELOCITY V_u = 60 m/s

UNIT LIFTING:-

L1. ANY RELOCATION OF THE BUILDING FROM ITS ORIGINAL DESIGN LOCATION / ENVIRONMENT SHALL BE APPROVED BY BILL GAMBLE PROJECT CONSULTANTS BEFORE SUCH EVENTS

NOTES:- GENERAL UNIT SPECIFICATIONS

GENERAL:-

DESIGNATION:- 6.110m MASONRY BUILDING
SKILLION ROOF CHEMICAL STORAGE SHELTER

DIMENSIONS:- INTERNAL

WIDTH	3130mm	
LENGTH	5890mm	
HEIGHT	2755mm	

DIMENSIONS:- EXTERNAL (INC. OVERHANGS, AC UNITS, ETC)

WIDTH	3440mm	APPROX.
LENGTH	6160mm	APPROX.
HEIGHT	3230mm	

WEIGHT:-
DELIVERED WEIGHT 22,200 kg (DESIGN)

① PROFESSIONAL SERVICES-ENGINEERING
PROJECT: HAY ST M/L
REF: _____ DATE: 22/5/97
☐ INFORMATION
☐ WORKING PAPERS
☐ EXTERNAL DOCUMENT, ACCEPTED FOR USE
☐ FOR CHECKING
☐ VERIFIED BY: M. KOHL
☐ OTHER: _____

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PRINTS	REVISIONS			
	AC	24/8/98	As Constructed	
	A	22/5/97	GENERAL	

THIS IS TO CERTIFY THAT THIS DOCUMENT HAS BEEN CHECKED AND COMPLIES WITH THE RELEVANT A.S. CODES.

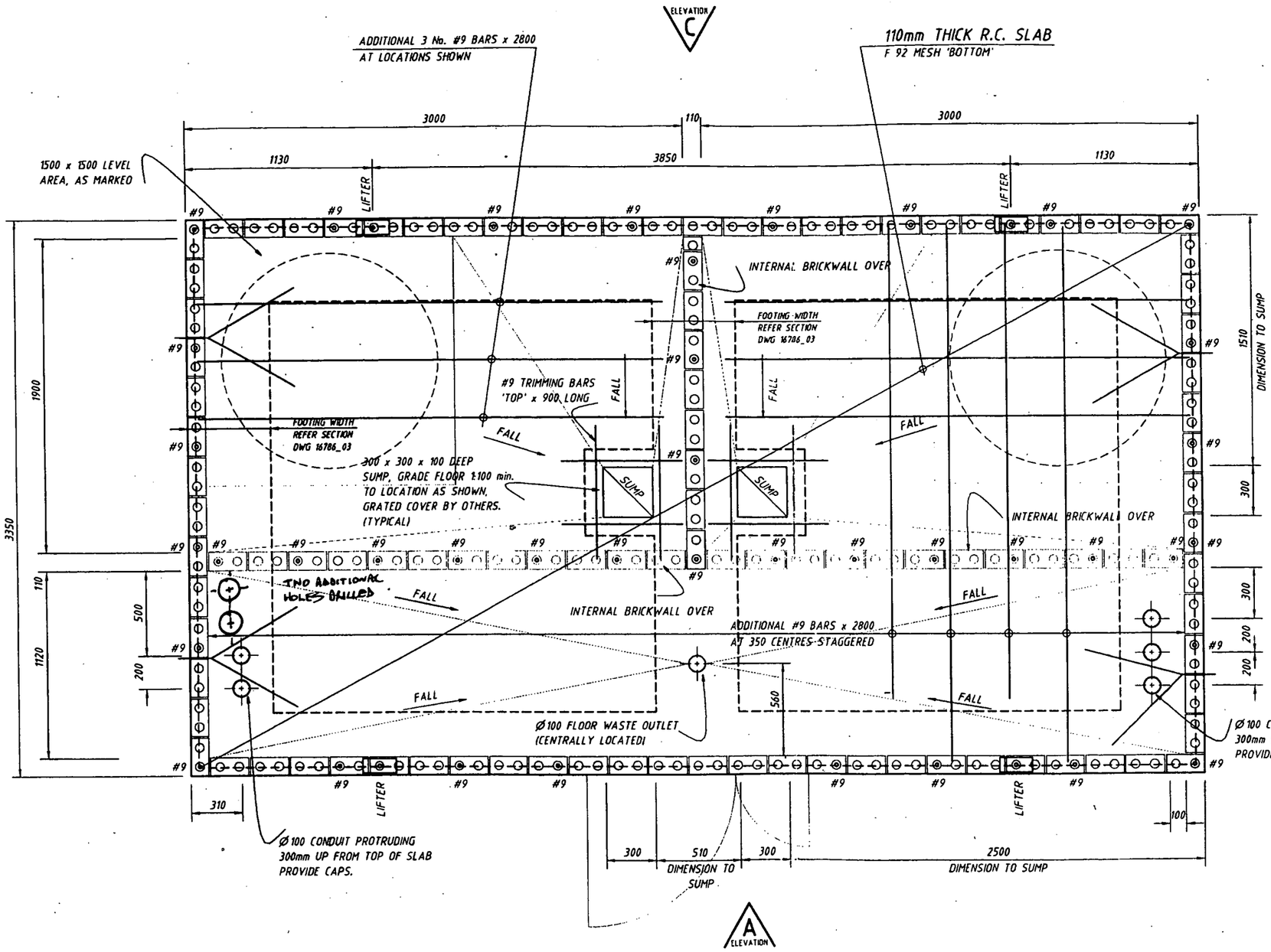
W. F. B. GAMBLE M.I.E. AUST.

A.C.N. 006 598 429
Delivery Address: Rear of Boral Brick Plant, Cathies Lane, Scoresby 3179
63A Mclenc Street, (P.O. Box 523) BARNSDALE, VIC. 3195
Telephone: (0351) 53 0477
Facsimile: (0351) 57 5115
Postal Address: C/- Post Office, Wonga Park 3115
Telephone: (03) 9887 0933
Facsimile: (03) 9887 0761
BARRIER ENGINEERING AND CONSTRUCTION
REINFORCED BRICK PANELS
Cathies Lane, SCORESBY (P.O.Box 1023, GLEN WAVERLEY 3150)
Telephone: (03) 9887 0767
Facsimile: (03) 9887 0520
Bill Gamble Project Consultants
CONSULTING STRUCTURAL AND CIVIL ENGINEERS. ESTABLISHED 1978 A.C.N. 005 231 265
1-3 Church Street, BRANXHOLME, VIC. 3844
Telephone: (0351) 74 7566
Facsimile: (0351) 74 9392
70 Market Street, SOUTH MELBOURNE, VIC. 3205
Telephone: (03) 9645 7552
Facsimile: (03) 9645 7553

FACE SHEET
6.11m x 3.35m (EXTERNAL), SKILLION ROOF WITH CONCRETE FLOOR

PROJECT
BRISBANE CITY COUNCIL : HAY STREET
DESCRIPTION : Brisbane Water Chemical Storage

DESIGNED	DRAWN		SCALE	DATE	DRAWING No	REV.
M.BROWN	A.HAGGART		1:20	MAY 1997	17357_01	A



PLAN AT FIRST COURSE LEVEL.

SECOND COURSE : FLOOR LEVEL
SLAB : SECOND COURSE QUEEN CLOSURE
REFER SECTION DWG 17357_03

SITE PREPARATION

STRIP OFF ANY SURFACE VEGETATION AND TOP SOIL CONTAINING SIGNIFICANT AMOUNTS OF ORGANIC MATTER AND LEVEL BUILDING AREA. THE DEPTH OF STRIPPING MAY VARY UP TO 300mm. (MINIMUM BEARING PRESSURE 50 KPA).

FLOOR LEVEL TO BE 150mm ABOVE FINISHED SURFACE LEVEL. WHERE ANY OVER EXCAVATION OCCURS REPLACE WITH CLASS 3 CRUSHED ROCK OR APPROVED EQUIVALENT. COMPACT TO AT LEAST 95% MAXIMUM DRY DENSITY ACHIEVED IN THE STANDARD COMPACTION TEST AS 1289 E1.1

IF ANY SOFT SPOTS ARE ENCOUNTERED, COMPACT THE MATERIAL TO MATCH THE DENSITY OF THE SURROUNDING SOIL.
BILL GAMBLE CONSULTANTS ENGINEER TO BE NOTIFIED IF ANY UNUSUAL FEATURES SHOULD BE ENCOUNTERED DURING EXCAVATION.

NOTE:-

FLOOR LOADINGS:-

A. REFER TO FACE SHEET (DRAWING 17357_01) FOR FLOOR LOADINGS

B. REFER TO NOTES (DRAWING 17357_01) FOR CONCRETE DETAILS

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PRINTS	REVISIONS		
	AC	24/8/98	As Constructed
	A	22/5/97	General

THIS IS TO CERTIFY THAT THIS DOCUMENT HAS BEEN CHECKED AND COMPLIES WITH THE RELEVANT A.S. CODES.

W. F. B. GAMBLE M.I.E. AUST.

A.C.N. 006 518 429
Delivery Address:
Rear of Boral Brick Plant
Cathies Lane
Scoresby 3179

BARRIER
ENGINEERING AND CONSTRUCTION
DESIGN OFFICE IN BRICKS PARTNERS

Postal Address:
C/- Post Office
Wonga Park 3115
Telephone: (03) 9887 0933
Facsimile: (03) 9887 0761

63A Macleod Street, (P.O. Box 529)
BAIRNSDALE, VIC. 3875
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Facsimile: (0351) 52 5115

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Facsimile: (03) 9887 0520

Bill Gamble Project Consultants
CONSULTING STRUCTURAL AND CIVIL ENGINEERS.
ESTABLISHED 1978 A.C.N. 005 231 265

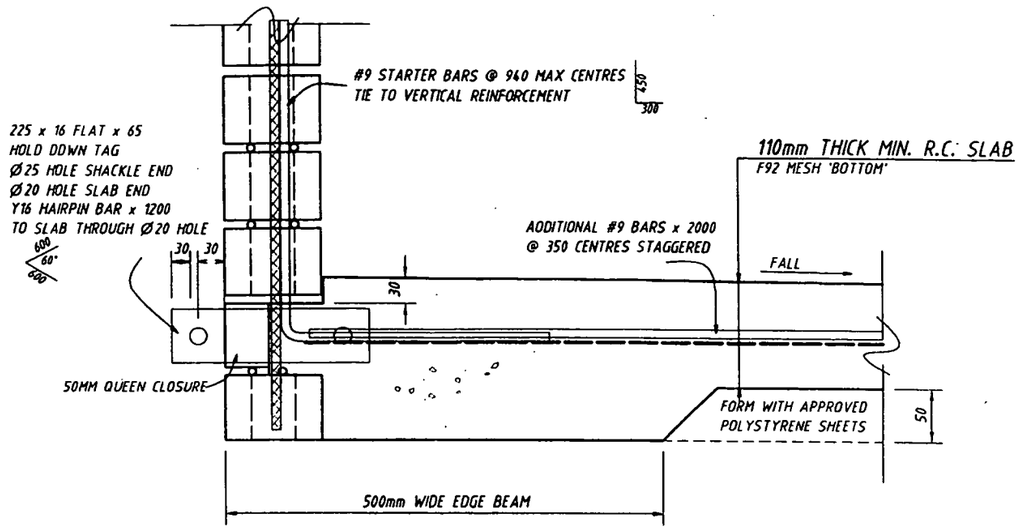
1-3 Church Street,
TRARALGON, VIC, 3844
Telephone: (0351) 74 7586
Facsimile: (0351) 74 9992

70 Market Street,
SOUTH MELBOURNE, VIC, 3205
Telephone: (03) 9645 7552
Facsimile: (03) 9645 7553

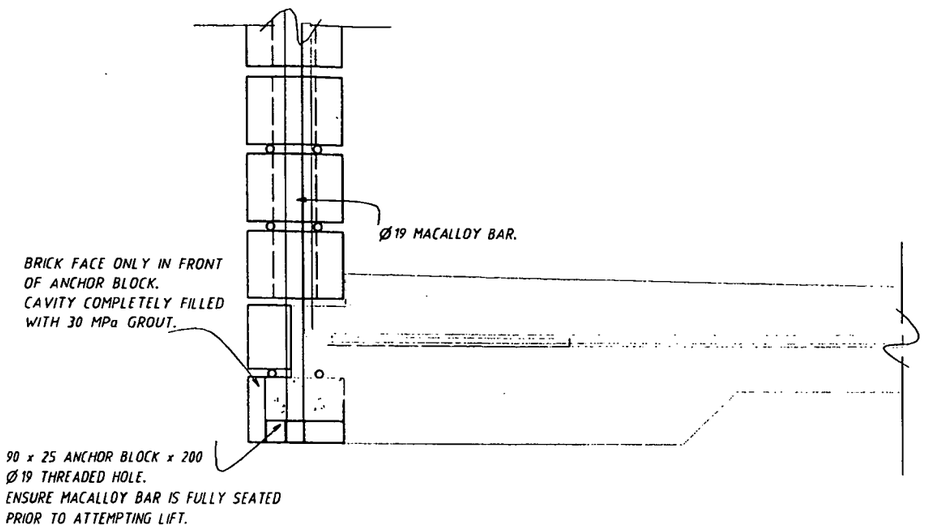
PLAN AT FIRST COURSE LEVEL
6.11m x 3.35m (EXTERNAL), SKILLION ROOF WITH CONCRETE FLOOR

PROJECT
BRISBANE CITY COUNCIL : HAY STREET
DESCRIPTION : Brisbane Water Chemical Storage

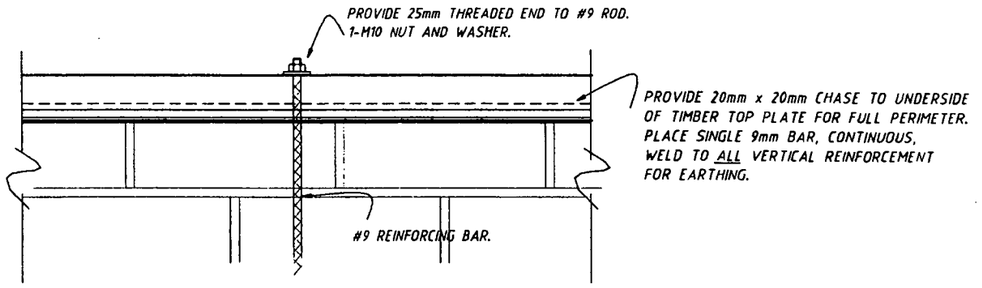
DESIGNED	DRAWN		SCALE	DATE	DRAWING No.	REV.
M.BROWN	A.HAGGART		1:20	MAY 1997	17357_02	A



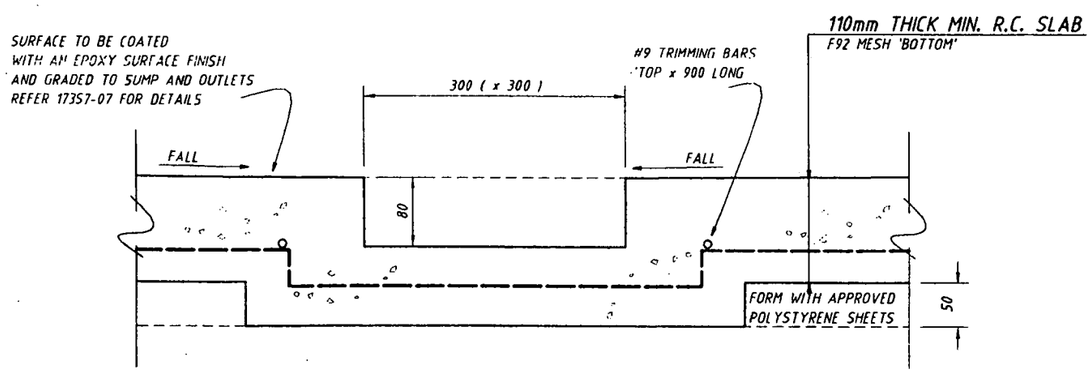
DETAIL 2.
SCALE 1 : 5



LIFTING ANCHOR BLOCK DETAIL
SCALE 1 : 5



ROD CONNECTION TO NAIL PLATE
SCALE 1 : 5



SUMP DETAIL
SCALE 1 : 5

CONCRETE NOTES
1/ LIGHTWEIGHT AGGREGATE (SCORIA) TO BE USED
2/ CONCRETE STRENGTH : 32 MPa
3/ CURE SLAB WITH POLYETHYLENE SHEETS WEIGHTED DOWN WITH SAND
4/ USE 'CALTITE' WATERPROOFING SYSTEM BY CEMENTAID

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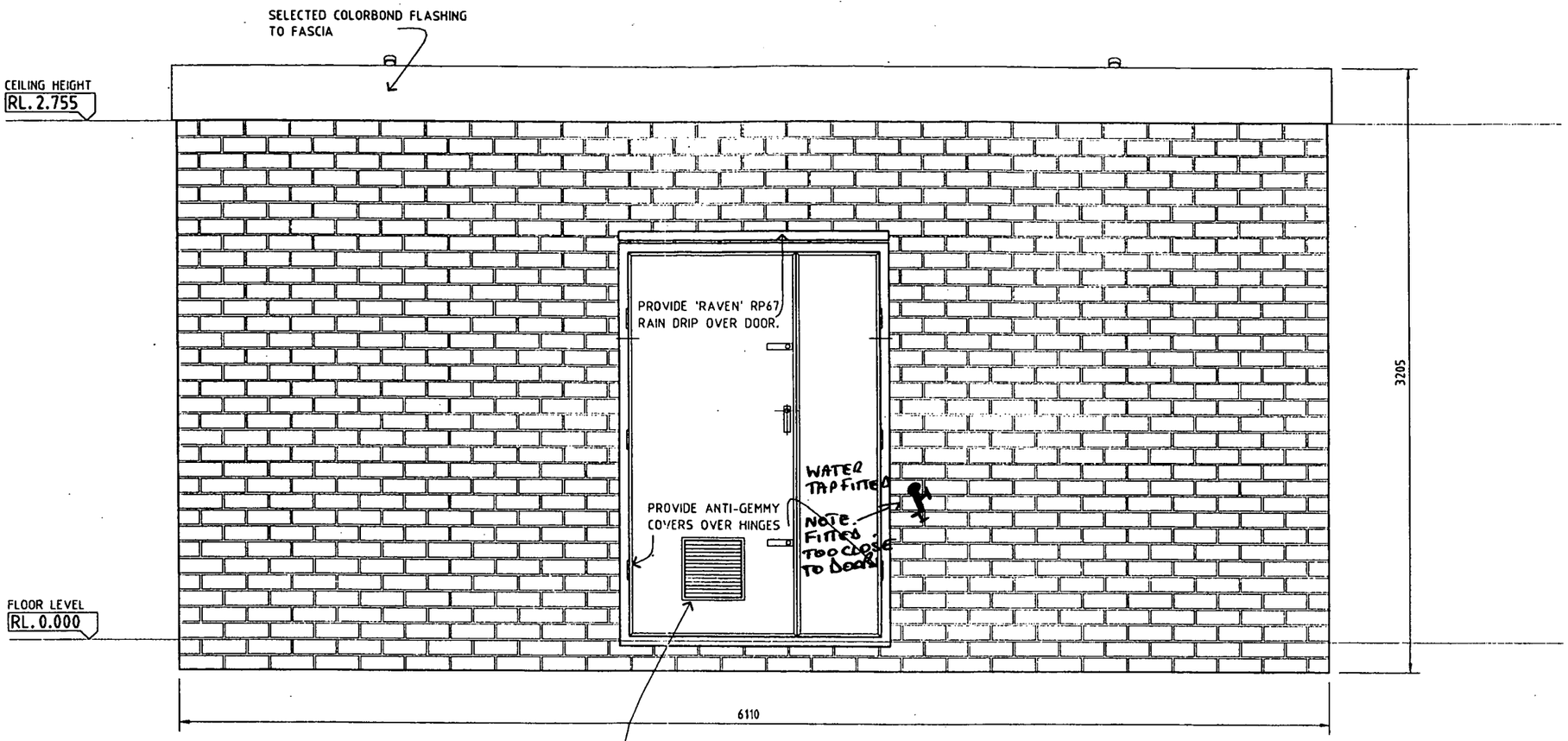
FOOTING DETAILS
6.11m x 3.35m (EXTERNAL), SKILLION ROOF WITH CONCRETE FLOOR

PROJECT
BRISBANE CITY COUNCIL : HAY STREET
DESCRIPTION : Brisbane Water Chemical Storage

DESIGNED	DRAWN		SCALE	DATE	DRAWING No.	REV.
M.BROWN	A.HAGGART	88	1:20	MAY 1997	17357_03	A



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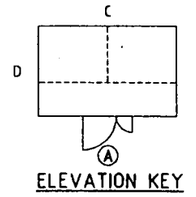

ELEVATION KEY

NOTE:
REFER TO FIT OUT LEGEND
DRAWING NO 17357-12

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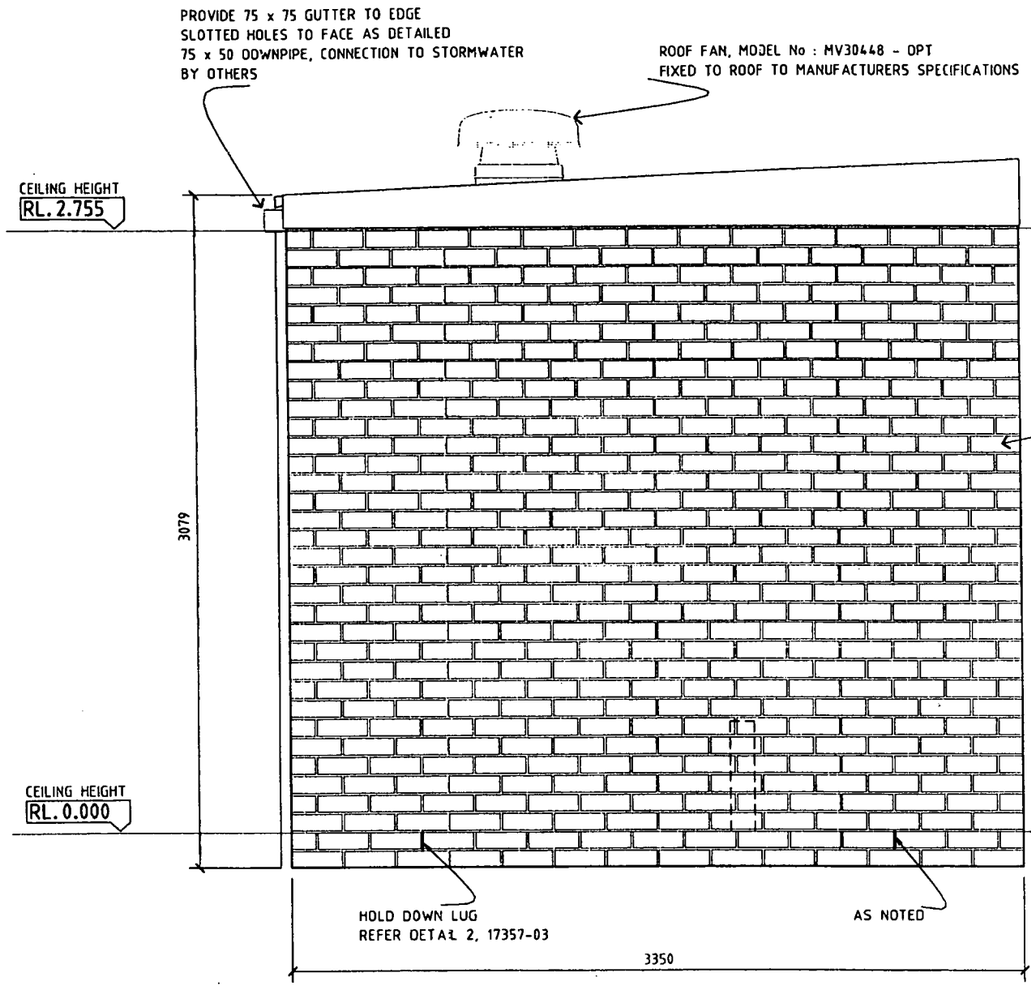
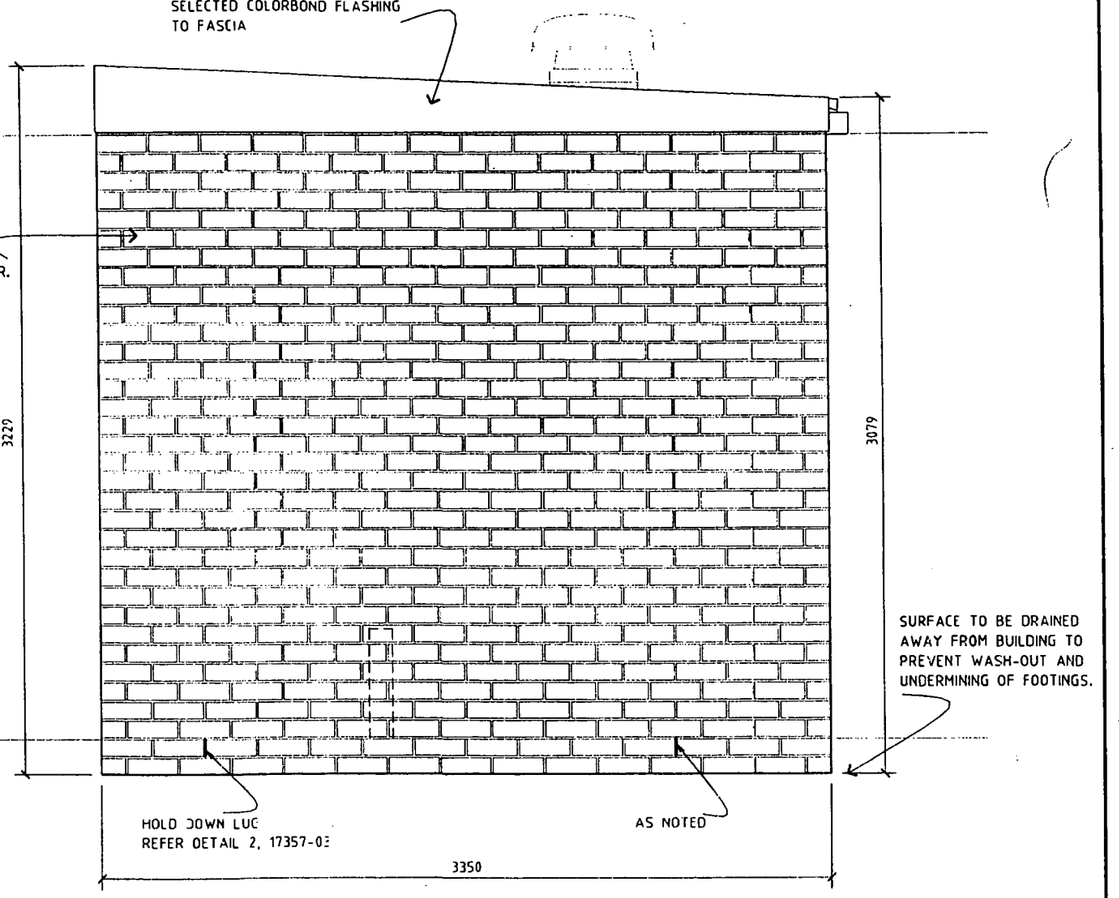
EXTERNAL ELEVATION A
6.11m x 3.35m (EXTERNAL), SKILLION ROOF WITH CONCRETE FLOOR

PROJECT
BRISBANE CITY COUNCIL : HAY STREET
DESCRIPTION : Brisbane Water Chemical Storage

DESIGNED	DRAWN		SCALE	DATE	DRAWING No.	REV.
M.BROWN	A.HAGGART		1:20	MAY 1997	17357_04	A



ELEVATION D



ELEVATION B

NOTE:
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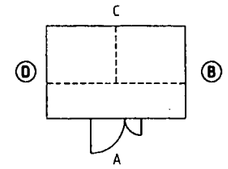

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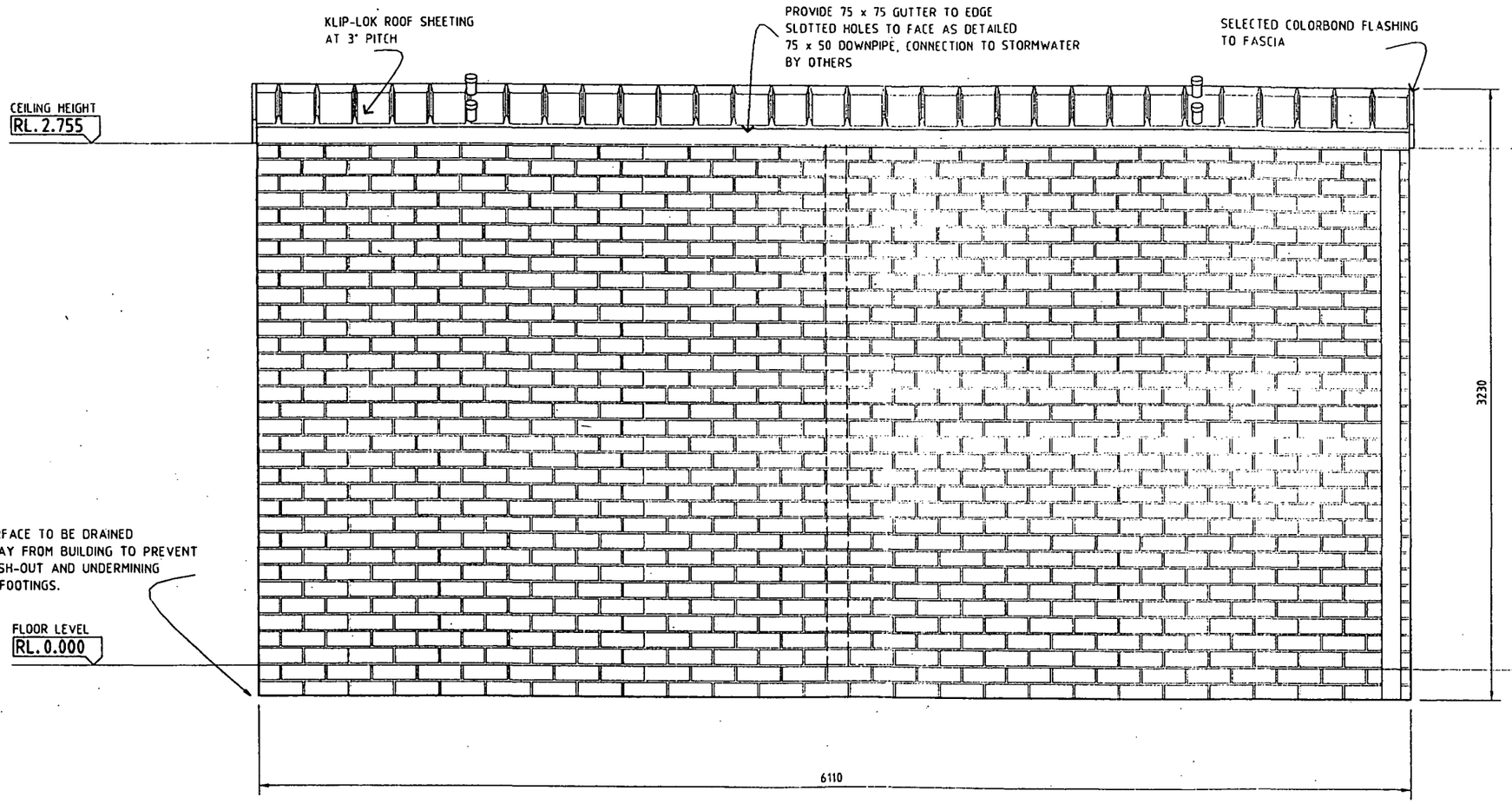
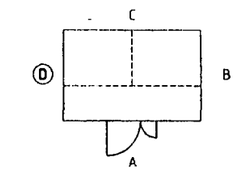
EXTERNAL ELEVATION B AND D
5.89m x 3.25m (INTERNAL), SKILLION ROOF WITH CONCRETE FLOOR

PROJECT
BRISBANE CITY COUNCIL : HAY STREET
DESCRIPTION : Brisbane Water Chemical Storage

DESIGNED	DRAWN		SCALE	DATE	DRAWING No.	REV.
M.BROWN	A.HAGGART		1:20	MAY 1997	17357_05	A



ELEVATION D



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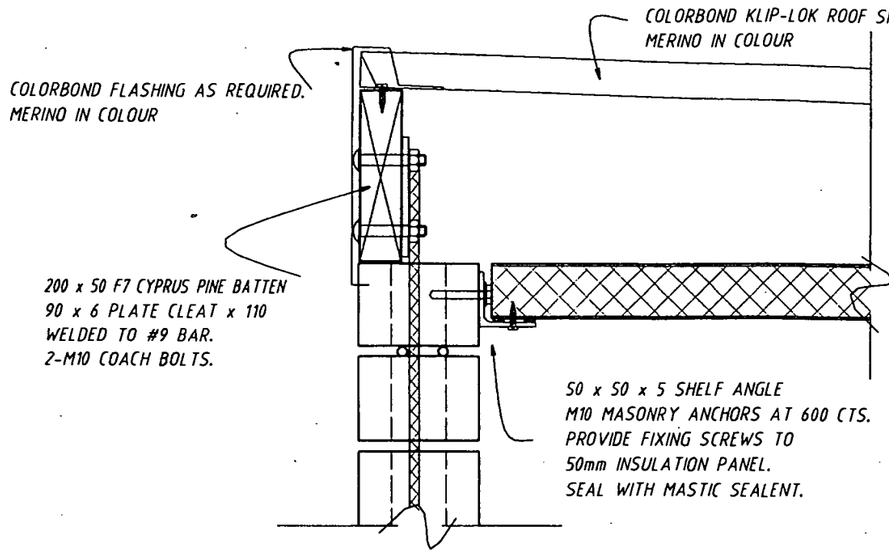
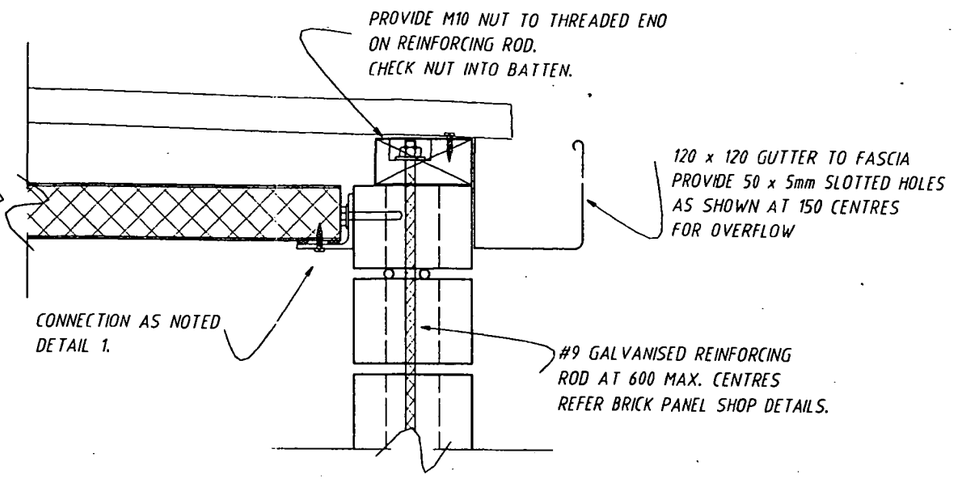
EXTERNAL ELEVATION D
5.89m x 3.25m (INTERNAL), SKILLION ROOF WITH CONCRETE FLOOR

PROJECT
BRISBANE CITY COUNCIL : HAY STREET
DESCRIPTION : Brisbane Water Chemical Storage

DESIGNED	DRAWN		SCALE	DATE	DRAWING No.	REV.
M.BROWN	A.HAGGART		1:20	MAY 1997	17357_06	A



DETAIL 1.



DETAIL 3.

NOTE:- CONCRETE

1. LIGHTWEIGHT AGGREGATE (SCORIA) TO BE USED
2. CONCRETE STRENGTH : 32 MPa
3. CURE SLAB WITH POLYTHENE SHEETS WEIGHTED DOWN WITH SAND
4. USE 'CALTITE' WATERPROOFING SYSTEM BY CEMENTAID

NOTE:- SURFACE FINISHES

GENERAL:-

A. 'SELLEYS' 'NO MORE GAPS' SEALANT TO BE USED INTERNALLY WHERE REQUIRED OR NOTED ON DRAWINGS FOR THE SEALING OF GAPS
AN APPROVED SILICONE SEALANT SHALL BE USED WHERE REQUIRED TO EXTERNAL CONDITIONS AS NOTED ABOVE. SILICONE SEALANT SHALL NOT BE USED INTERNALLY.

B. FLASHING FINISH AND COLOR TO MATCH INSULATION PANEL EXTERNAL FINISH.

FLOOR:-

C. FLOORS TO BE COATED WITH 'EPIREZ - SUPATUFF RA' APPLICATION TO MANUFACTURERS SPECIFICATIONS
COLOUR TO BE ADVISED BY BARRIER P/L.

WALLS:-

D. INTERNAL WALLS TO BE COATED WITH 'EPIREZ - SUPATUFF RA' APPLICATION TO MANUFACTURERS SPECIFICATIONS
COLOUR TO BE ADVISED BY BARRIER P/L.

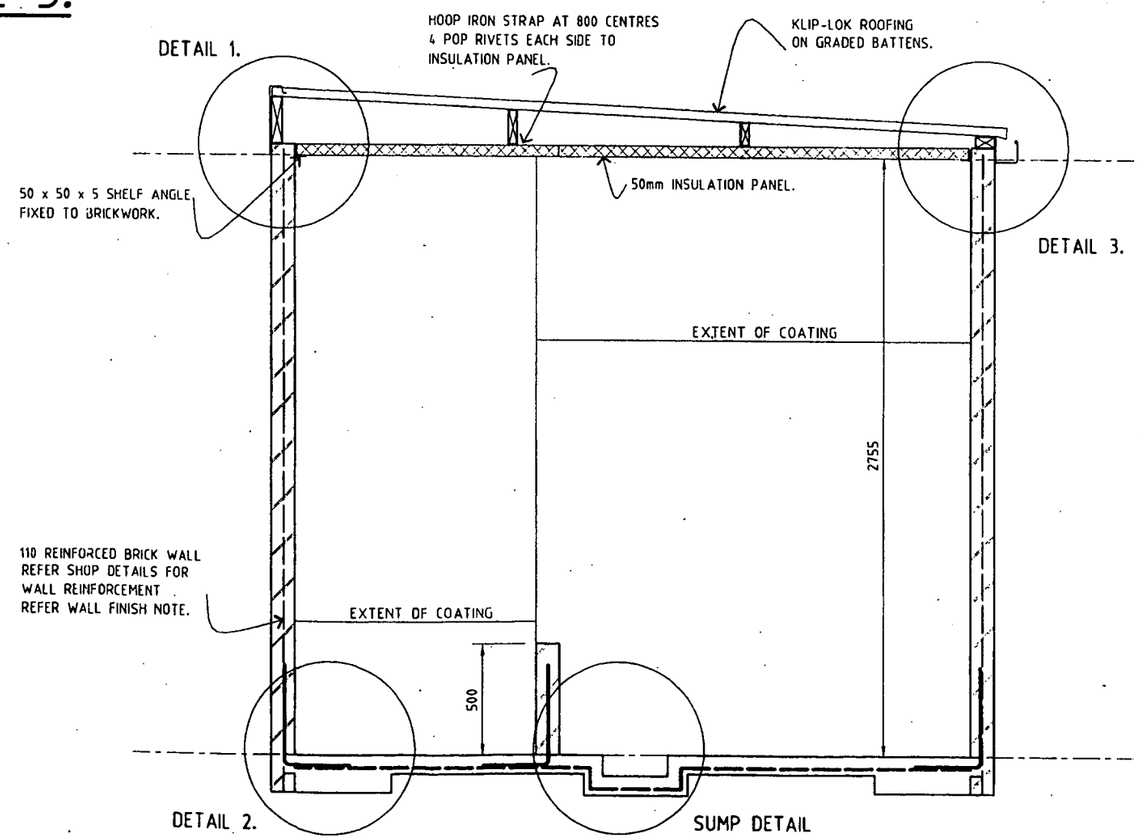
EXTERNAL WALLS TO BE COATED WITH 'EPIREZ MOISTURE BLOCK 'S" APPLICATION TO MANUFACTURERS SPECIFICATION.

ADD 'KRYSTOL' WATERPROOFING TO MORTAR FOR LOWER THREE COURSES. APPLICATION TO MANUFACTURERS SPECIFICATION.

FINAL EXTERNAL WALL SURFACE TO BE COATED IN EPIREZ GRAFFITI BLOCK 'S' ANTI-GRAFFITI COATING.

FLASHINGS:-

E. USE 0.6mm COLORBOND FLASHING BENT TO REQUIRED SHAPE.



TYPICAL CROSS SECTION

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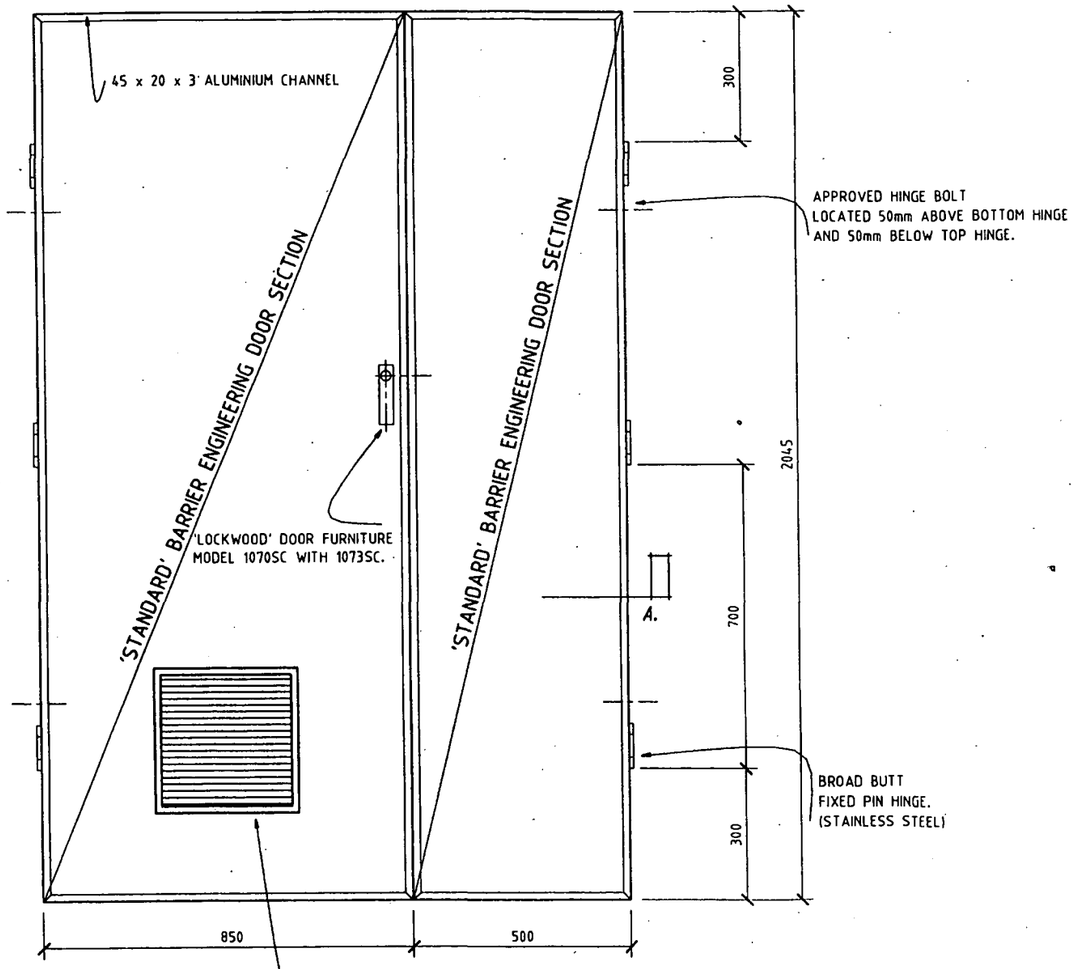
TYPICAL SECTION AND DETAILS
6.11m x 3.35m (EXTERNAL), SKILLION ROOF WITH CONCRETE FLOOR

PROJECT
BRISBANE CITY COUNCIL : HAY STREET
DESCRIPTION : Brisbane Water Chemical Storage

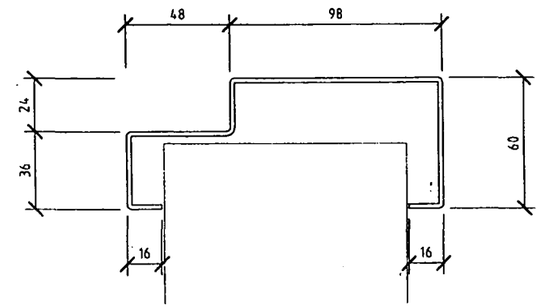
DESIGNED	DRAWN		SCALE	DATE	DRAWING No.	REV.
M.BROWN	A.HAGGART		1:20	MAY 1997	17357 07	A



ELEVATION

NOTE :
REQUIRE 1300 MIN.
CLEARANCE FOR DOORWAY OPENING.

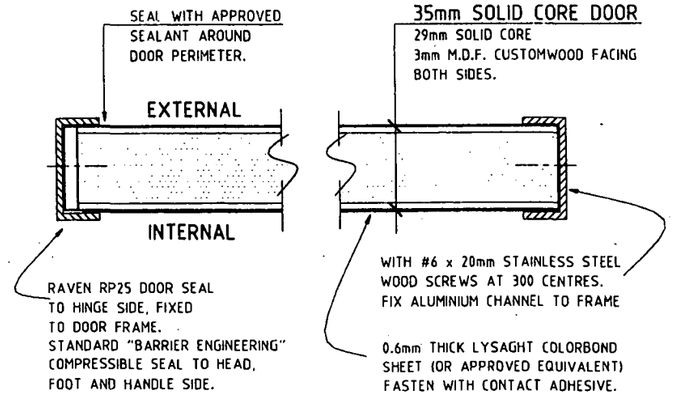
300 x 300 DOOR LOUVRES
TO BARRIER P/L SPECIFICATIONS.
WITH VANDEL PROOF GRILL



DOOR FRAME DETAIL

SCALE 1 : 2

FRAME TO FULL PERIMETER OF DOOR
(ALSO USED FOR CABLE ENTRY FRAME)



SECTION A. - A.

SCALE 1 : 2

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DOOR DETAILS
6.11m x 3.35m (EXTERNAL), SKILLION ROOF WITH CONCRETE FLOOR

PROJECT
BRISBANE CITY COUNCIL : HAY STREET
DESCRIPTION : Brisbane Water Chemical Storage

DESIGNED	DRAWN		SCALE	DATE	DRAWING No.	REV.
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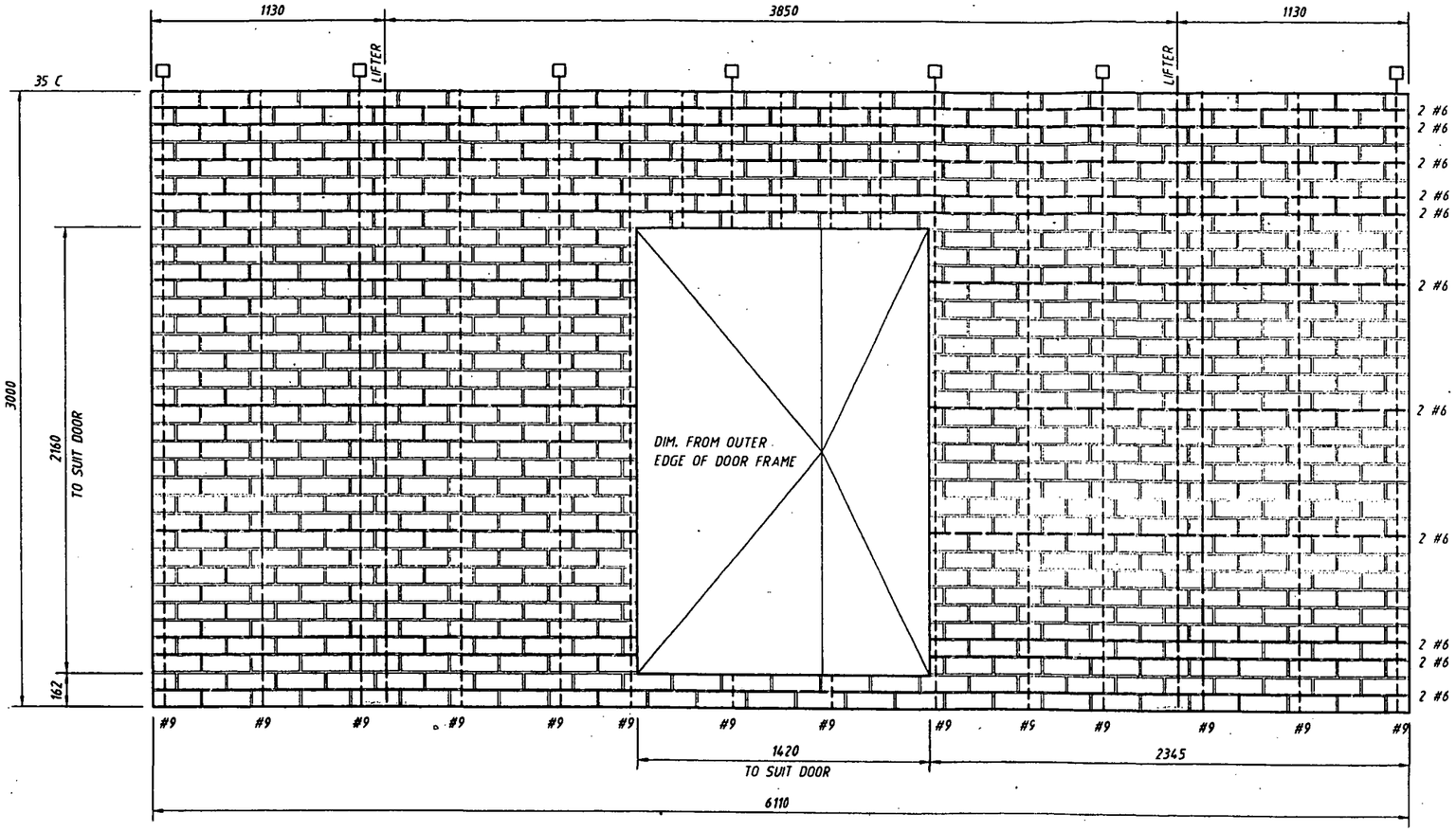


ELEVATION A

MACALLOY BARS.

Ø19 MACALLOY BARS x LONG
25mm THREAD TO BOTTOM OF BAR. 45mm TO TOP END
TOP 1500mm OF BAR TO BE GREASED AND SHEATHED.

NOTE:

BEFORE COREING, DRILLING OR CUTTING INTO BRICKWORK, BARRIER ENGINEERING Pty. Ltd. TO BE CONSULTED TO ASCERTAIN IMPLICATIONS ON STRUCTURE PERFORMANCE

(DO NOT INTERFERE WITH LIFTERS)

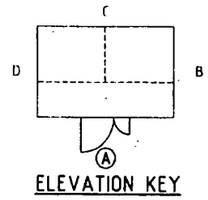
ALL VERTICAL REINFORCEMENT TO PROJECT 50mm (min.) FROM TOP COURSE TO ALLOW WELDING TO EARTHING ROD

BARS TRIMMED BACK (OR THREADED FOR TOP PLATE CONNECTION) AFTER WELDING.

LEGEND:

□ DENOTES FASCIA FIXING BRACKET CAST INTO CORE FILL.

* DENOTES VERTICAL REINFORCEMENT WITH 75mm PROJECTION, 50mm THREADED END, FOR FIXING OF TOP PLATE



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SHOP DETAIL ELEVATION A
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BRISBANE CITY COUNCIL : HAY STREET
DESCRIPTION : Brisbane Water Chemical Storage

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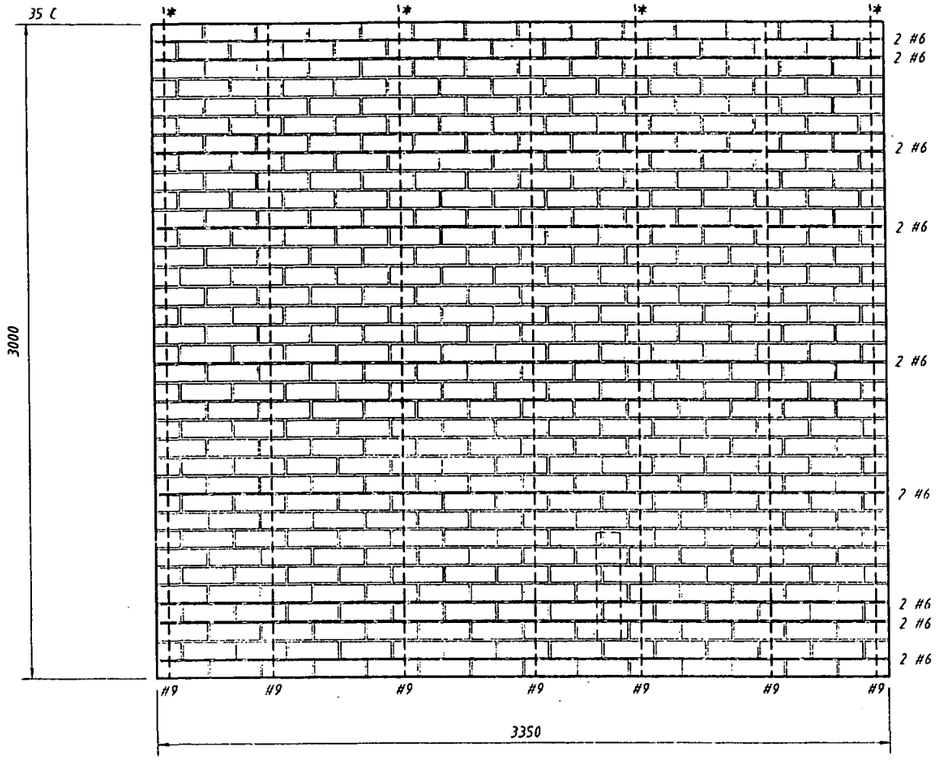
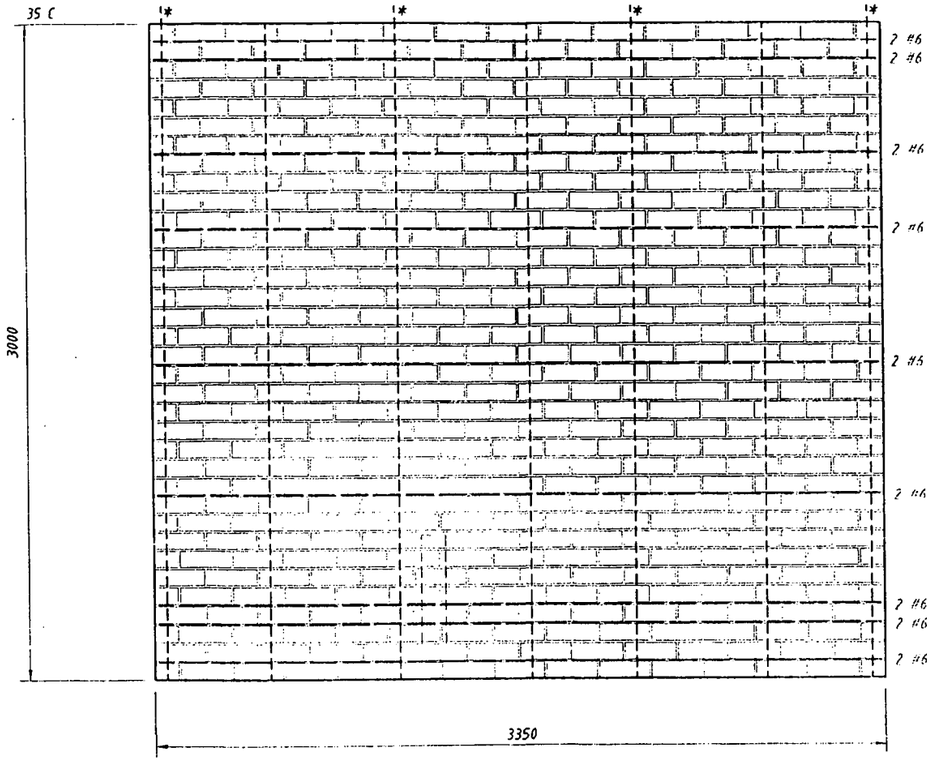


ELEVATION D



ELEVATION B

NOTE:

BEFORE COREING, DRILLING OR CUTTING INTO BRICKWORK, BARRIER ENGINEERING Pty. Ltd. TO BE CONSULTED TO ASCERTAIN IMPLICATIONS ON STRUCTURE PERFORMANCE

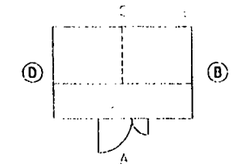
(DO NOT INTERFERE WITH LIFTERS)

ALL VERTICAL REINFORCEMENT TO PROJECT 50mm (min.) FROM TOP COURSE TO ALLOW WELDING TO EARTHING ROD

BARS TRIMMED BACK (OR THREADED FOR TOP PLATE CONNECTION) AFTER WELDING.

⊛ WELD EARTH FIXING PLATE TO HORIZONTAL REINFORCEMENT PROJECT EXTERNALLY

* DENOTES VERTICAL REINFORCEMENT WITH 75mm PROJECTION, 50mm THREADED END, FOR FIXING OF TOP PLATE



ELEVATION KEY

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	AC 24/8/96	AS CONSTRUCTED NO CHANGES
	A 22/5/97	GENERAL

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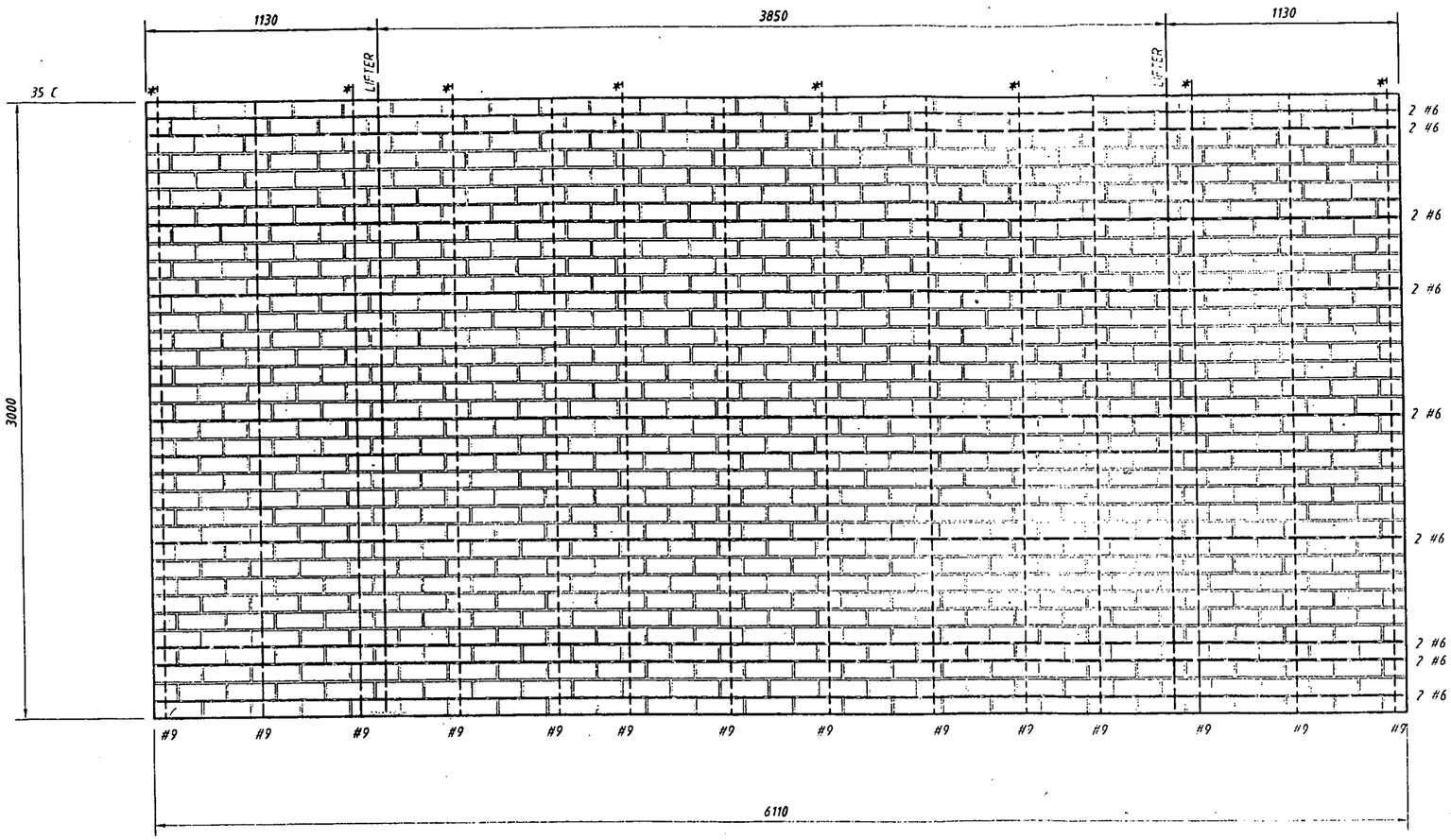
SHOP DETAIL ELEVATION B and D
6.11m x 3.35m (EXTERNAL), SKILLION ROOF WITH CONCRETE FLOOR

PROJECT
BRISBANE CITY COUNCIL : HAY STREET
DESCRIPTION : Brisbane Water Chemical Storage

DESIGNED	DRAWN		SCALE	DATE	DRAWING No.	REV.
M.BROWN	A.HAGGART	BG	1:20	MAY 1997	17357_10	A



ELEVATION C

MACALLOY BARS.

Ø19 MACALLOY BARS x LONG
25mm THREAD TO BOTTOM OF BAR. 45mm TO TOP END
TOP 1500mm OF BAR TO BE GREASED AND SHEATHED.

NOTE:

BEFORE COREING, DRILLING OR CUTTING INTO BRICKWORK, BARRIER ENGINEERING Pty. Ltd. TO BE CONSULTED TO ASCERTAIN IMPLICATIONS ON STRUCTURAL PERFORMANCE

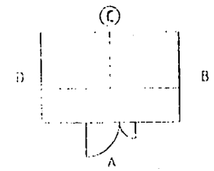
(DO NOT INTERFERE WITH LIFTERS)

ALL VERTICAL REINFORCEMENT TO PROJECT 50mm (min.) FROM TOP COURSE TO ALLOW WELDING TO EARTHING ROD

BARS TRIMMED BACK (OR THREADED FOR TOP PLATE CONNECTION) AFTER WELDING.

LEGEND:

* DENOTES VERTICAL REINFORCEMENT WITH 75mm PROJECTION, 50mm THREADED END, FOR FIXING OF TOP PLATE



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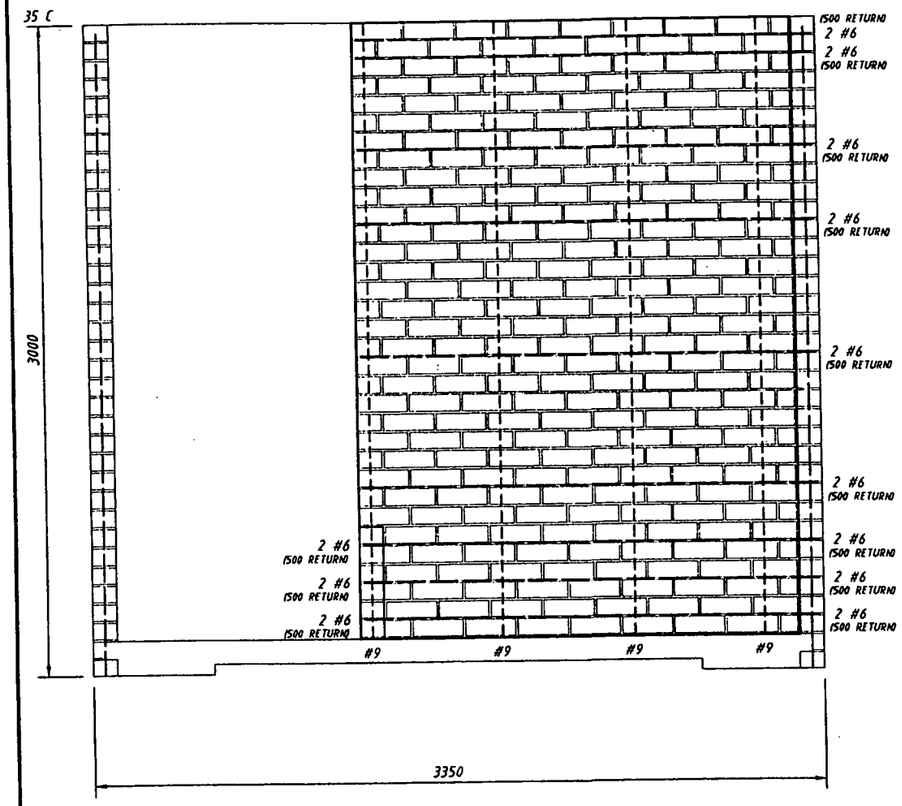
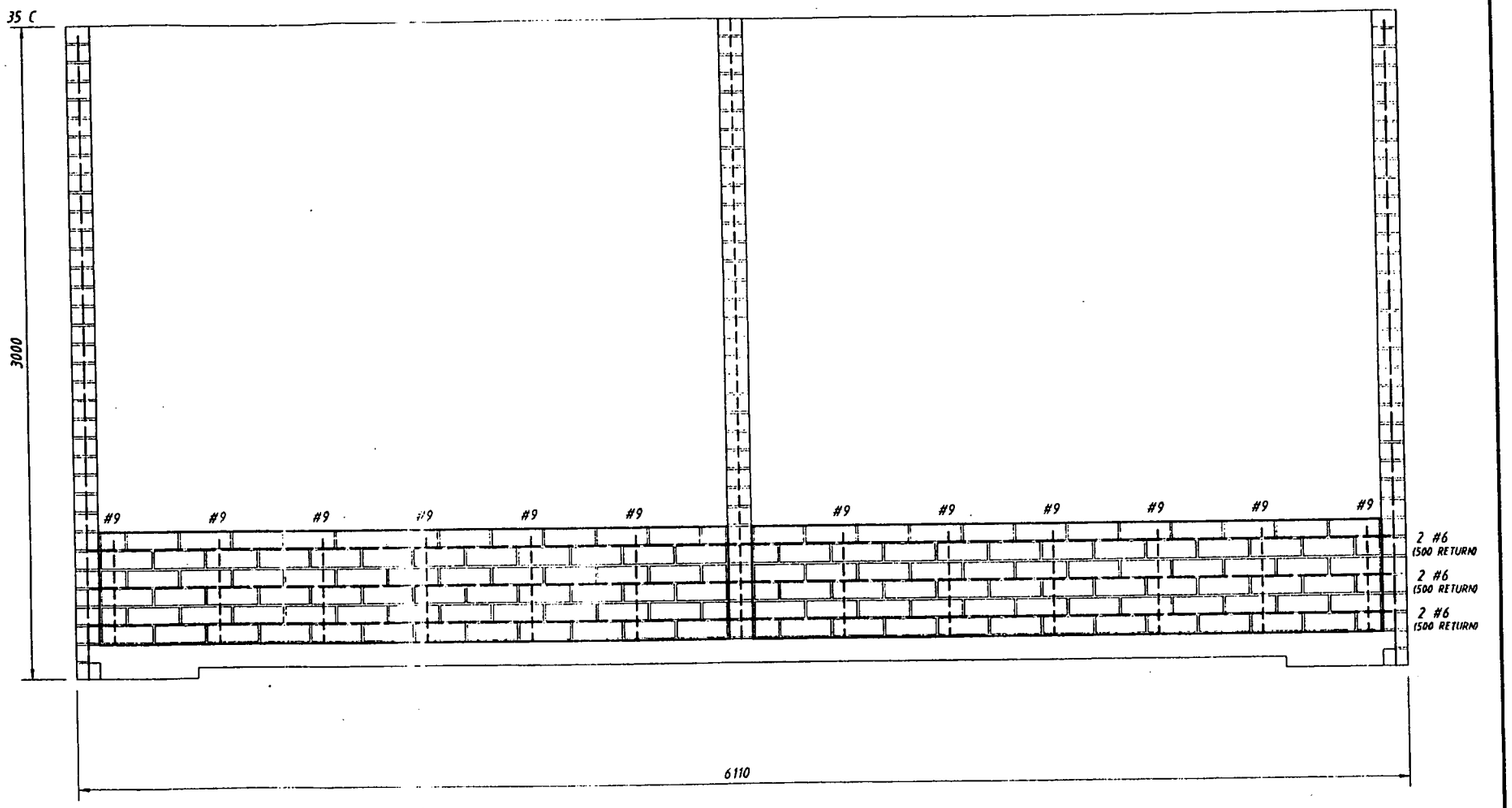
SHOP DETAIL ELEVATION C
6.11m x 3.35m (EXTERNAL), SKILLION ROOF WITH CONCRETE FLOOR

PROJECT
BRISBANE CITY COUNCIL : HAY STREET
DESCRIPTION : Brisbane Water Chemical Storage

DESIGNED	DRAWN		SCALE	DATE	DRAWING No.	REV.
M.BROWN	A.HAGGART		1:20	MAY 1997	17357 11	A



ELEVATION E



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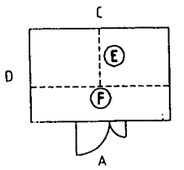

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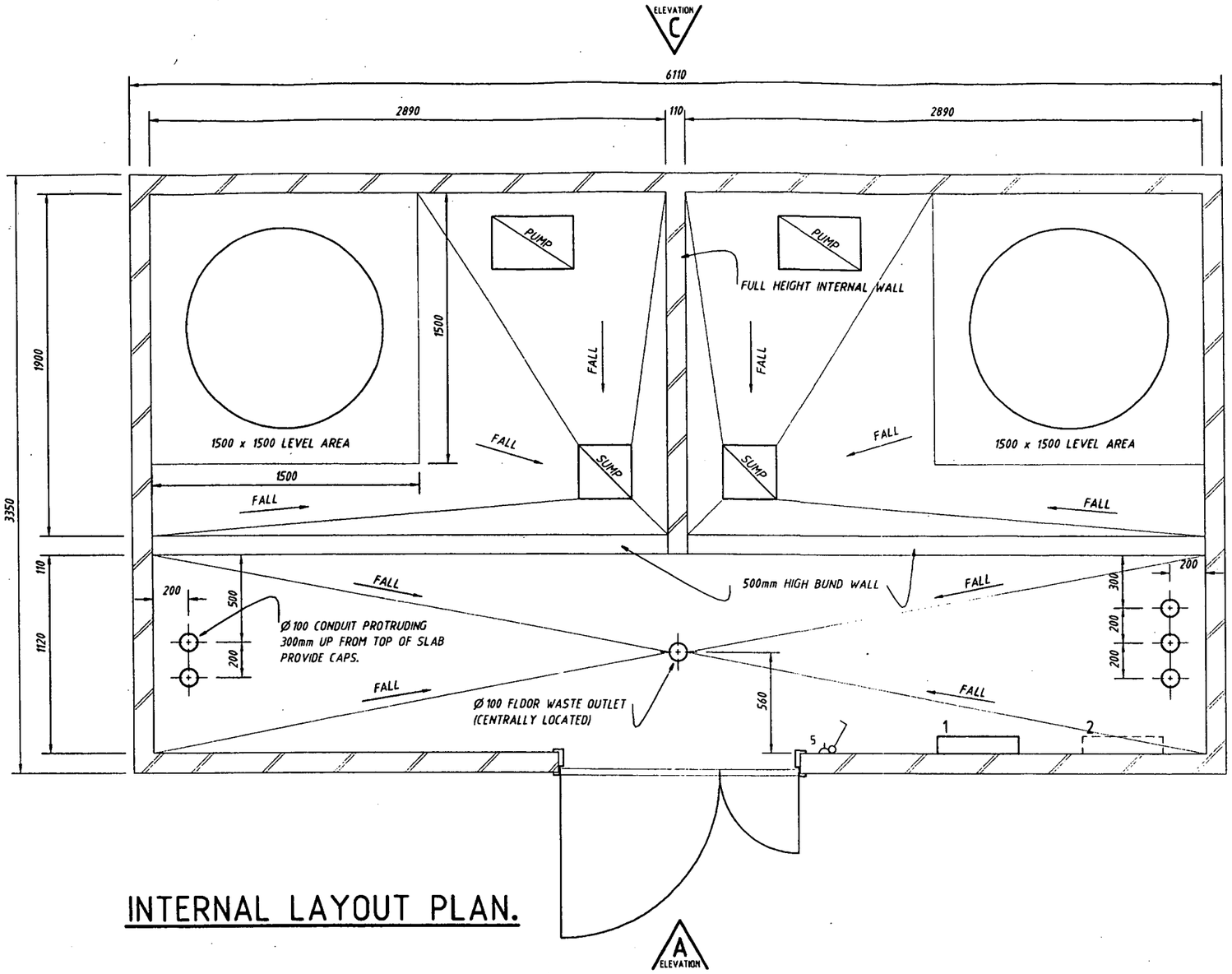
SHOP DETAIL ELEVATION E and F
6.11m x 3.35m (EXTERNAL), SKILLION ROOF WITH CONCRETE FLOOR

PROJECT
BRISBANE CITY COUNCIL : HAY STREET
DESCRIPTION : Brisbane Water Chemical Storage

DESIGNED	DRAWN		SCALE	DATE	DRAWING No.	REV.
M.BROWN	A.HAGGART		1:20	MAY 1997	17357_11A	A



INTERNAL LAYOUT PLAN.

INTERNAL FIT OUT LEGEND	
MARK	DESCRIPTION
1	SWITCH BOARD - HEINEMANN (OR EQUIVALENT) 3 CIRCUIT.
2	CONTROL BOX (BY OTHERS)
3	LIGHT SWITCH
4	FAN SWITCH
5	DOUBLE 250V 10 amp G.P.O. OUTLET (1000 AFL - UNO)
6	SINGLE 250V 15 amp FAN POWER OUTLET
7	TWIN 36W FLUORESCENT (WITH PLUG, SOCKET & DIFFUSER)
8	METERING PUMP

NOTE : CABLING TO WALL SURFACE CONTAINED WITHIN Ø 25 CONDUIT UNLESS NOTED.

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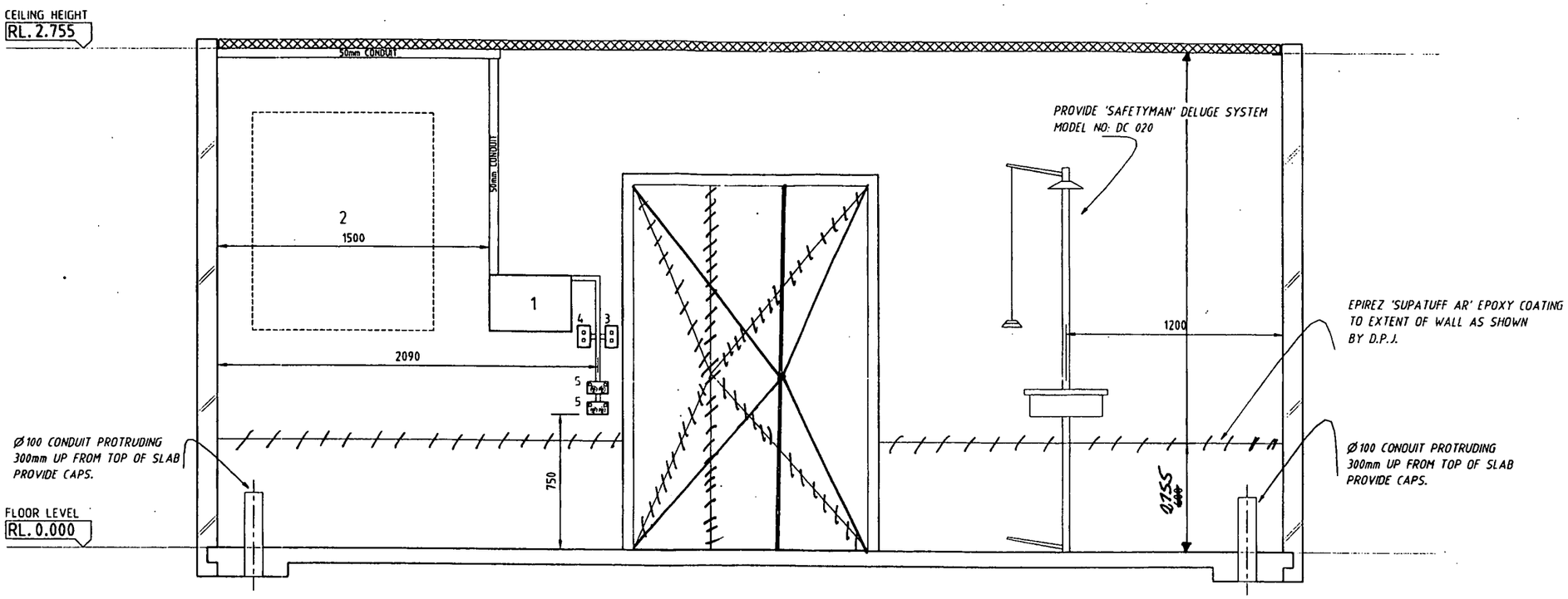
INTERNAL LAYOUT AND INTERNAL FIT OUT LEGEND
6.11m x 3.35m (EXTERNAL), SKILLION ROOF WITH CONCRETE FLOOR

PROJECT
BRISBANE CITY COUNCIL : HAY STREET
DESCRIPTION : Brisbane Water Chemical Storage

DESIGNED	DRAWN		SCALE	DATE	DRAWING No.	REV.
M.BROWN	A.HAGGART		1:20	MAY 1997	17357_12	A



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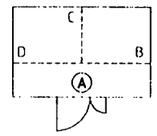

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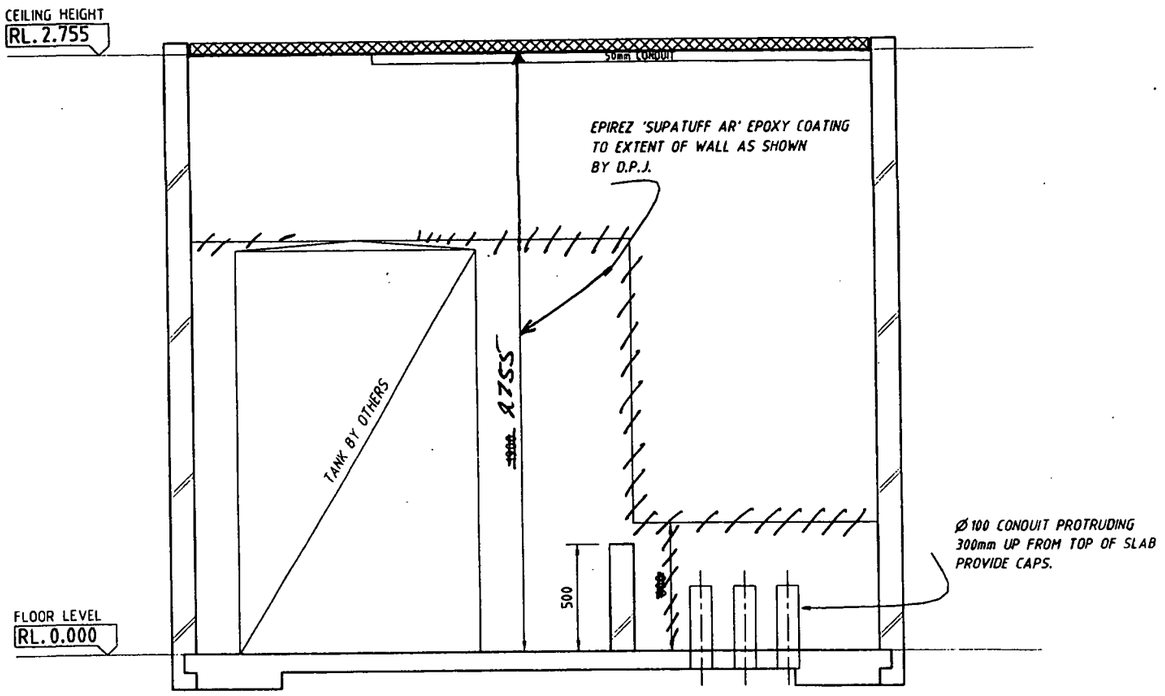
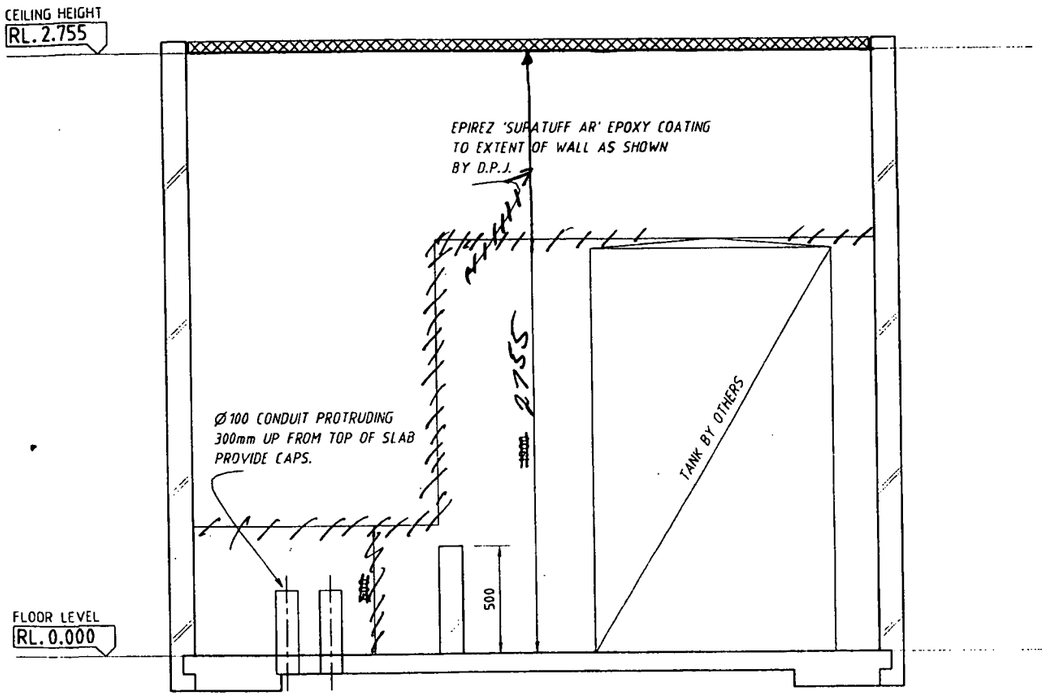
INTERNAL ELEVATION A
6.11m x 3.35m (EXTERNAL), SKILLION ROOF WITH CONCRETE FLOOR

PROJECT
BRISBANE CITY COUNCIL : HAY STREET
DESCRIPTION : Brisbane Water Chemical Storage

DESIGNED	DRAWN		SCALE	DATE	DRAWING No.	REV.
M.BROWN	A.HAGGART		1:20	MAY 1997	17357_13	A



(INTERNAL) ELEVATION B.



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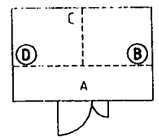

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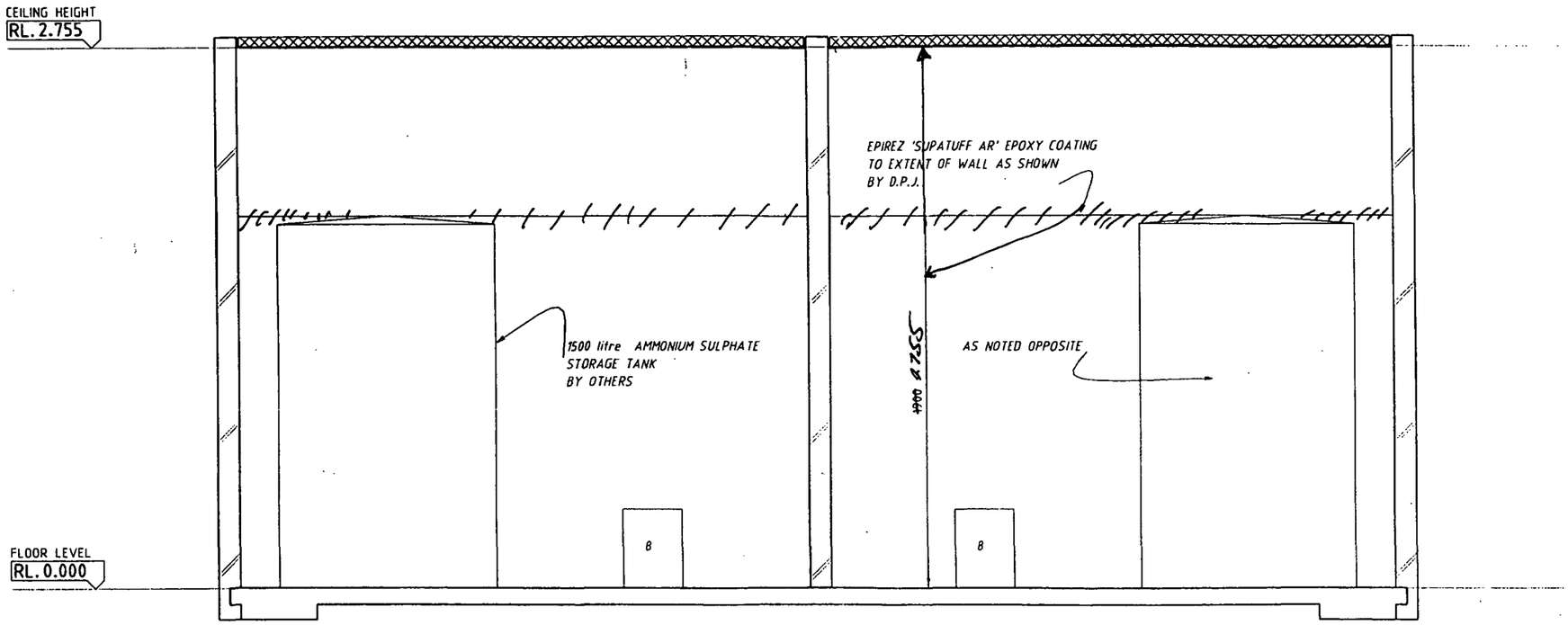
INTERNAL ELEVATION B AND D
5.89m x 3.25m (INTERNAL), SKILLION ROOF WITH CONCRETE FLOOR

PROJECT
BRISBANE CITY COUNCIL : HAY STREET
DESCRIPTION : Brisbane Water Chemical Storage

DESIGNED	DRAWN		SCALE	DATE	DRAWING No.	REV.
M.BROWN	A.HAGGART		1:20	MAY 1997	17357_14	A



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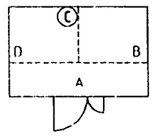

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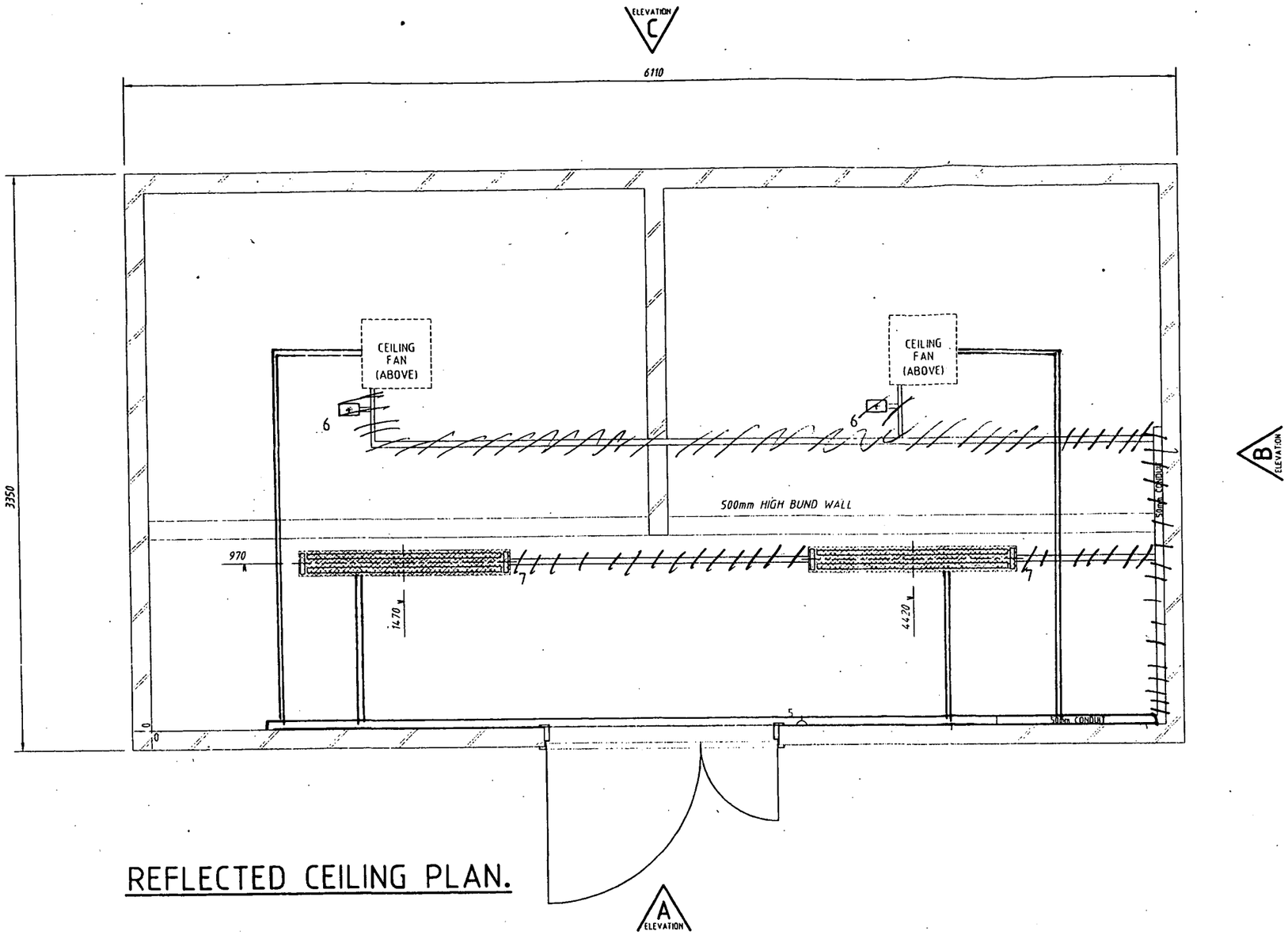
INTERNAL ELEVATION C
5.89m x 3.25m (INTERNAL), SKILLION ROOF WITH CONCRETE FLOOR

PROJECT
BRISBANE CITY COUNCIL : HAY STREET
DESCRIPTION : Brisbane Water Chemical Storage

DESIGNED	DRAWN		SCALE	DATE	DRAWING No.	REV.
M.BROWN	A.HAGGART		1:20	MAY 1997	17357_15	A



REFLECTED CEILING PLAN.

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REFLECTED CEILING PLAN
5.89m x 3.25m (INTERNAL), SKILLION ROOF WITH CONCRETE FLOOR

PROJECT
BRISBANE CITY COUNCIL : HAY STREET
DESCRIPTION : Brisbane Water Chemical Storage

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