



S.H.A Premier Constructions Pty Ltd

Underground Petroleum Storage System Specification of Works

Revision	Writer	Reviewer	Amendments	Date
B	GC	KS		04/05/2016
C	CL	KS	Refer highlighted items	03/01/2017

Intentionally Blank Page

## CONTENTS

1. GENERAL .....	5
2. ELECTRICAL .....	7
4. DECOMMISSIONING .....	10
5. TANK INSTALLATION .....	15
6. TANK TOP FITTINGS .....	20
7. FITTINGS LIST .....	21
8. FUEL SYSTEM INTEGRITY TEST .....	23
9. MONITORING SYSTEM .....	25
10. SUBMERSIBLE TURBINE PUMP .....	25
11. FORECOURT DISPENSERS AND PUMPS .....	26
12. COMMISSIONING .....	26
13. HANDOVER DOCUMENTATION .....	28

## 1. General

These works cover the installation and commissioning of:

- driveway dispensers /pumps
- submersible turbine pumps
- underground storage tanks
- pipework and fittings
- automatic tank gauging
- line leak detection
- containment sumps and monitoring
- spill containment devices
- overfill protection devices
- manway covers

All works are to be carried out with due regard to the safety of employees carrying out the work, other personnel employed on the site and third parties. All works shall be executed in accordance with statutory regulations pertaining to safe work practices. State Occupational Health and Safety Regulations and Contractors Safety for Service Stations, shall be observed at all times.

All new complete piping systems are to be proprietary pipework system as approved by the Superintendent and statutory authorities.

Nominated subcontractors only, are to carry out pump and tank work.

### 1.1 Service Station Building Contractor

The Builder is the principal Contractor on the site and will at all times make sure that necessary assistance is given with levels and locations of pumps and tanks. The fuel system contractor must coordinate his activities with the overall project construction schedule.

During installation it will be the fuel system contractor's responsibility to see that his work is not damaged by other trades.

However, after the fuel system contractor has left site on completion of installation, the builder will be responsible to see that no damage to tanks or pipelines (such as the passage of vehicles or heavy equipment) is permitted. Any work required to rectify damage through builder's neglect is to be made by fuel system contractor and all accounts rendered to the builder.

A final full systems test shall be carried out prior to handover and in the presence of the building contractor. The fuel system contractor shall provide to the building contractor a marked up plan indicating the lines of pipework as built.

This clause is applicable irrespective of whether the fuel system installer is a "Nominated Sub- Contractor" or are "Special Tradesmen".

### 1.2 Work permits

Work permit will be required from the Superintendent prior to commencement on site. Minimum 48 hours' notice must be given for this to be arranged.

### 1.3 Building Permits

All works are to be carried out in accordance with any planning and/or building permits issued.

## 1.4 Standards

This specification shall be read in conjunction with;

- AS 1940 - "The Storage and Handling of Flammable and Combustible Liquids"
- AS 4897 – "The Design, Installation and Operation of Underground Petroleum Storage Systems"
- AS 1596 – "The storage and handling of LPG gas"
- AS 60079 – "" Explosive atmospheres"
- Attached drawings
- Contract Specifications
- Suppliers and manufacturers specifications and manuals for equipment installation.
- All other Statutory Authority requirements pertaining to the excavation, installation of underground tanks, installation and alteration of underground pipework, installation and alteration of services lines and dispensers.
- APICSA recommended practices

## 1.5 Standard Drawings

Standard Drawings provide schematic information and typical details of how to assemble and install the various components of the fuel system. All fuel system works shall be completed using these standards.

## 1.6 Equipment Transportation and Handling

The Contractor shall make suitable arrangements for supply and delivery and unloading of tank(s) and any supply equipment, cart to site as necessary, unload, temporary safe storage and installation into correct position.

The Contractor is responsible for liaison with the Suppliers the equipment to coordinate the delivery of equipment to ensure that all works are carried out in their proper sequence without delays to the project. Refer to list of any equipment supplied by the Principal and confirm with the Superintendent at commencement of Works.

## 2 Electrical

The contractor is responsible for the supply and installation of all conduits and wiring including terminations for the fuel system including but not limited to forecourt controller (POS), forecourt dispensers/pumps, Submersible Turbine Pumps(STP's), ATG including probes, sensors and PLLD. Data cabling and termination boxes. Electrical earthing and bonding. All electrical works are to be carried out by licensed electricians. Registered under AS 4761 – “Competencies for working with electrical equipment for hazardous areas” and in accordance with AS 3000 – “Electrical installations”, AS 2381 – “Electrical equipment for explosive gas atmospheres.”

### 2.1 Fuels Switchboard

The fuel system electrician is responsible for the supply and installation of fuel system switchboard.

- The Switchboard is to be of NHP Concept Plus or equivalent quality.
- Construct the Switchboard such that emergency stop activation will isolate all power in the hazardous area.
- Populate the Switchboard with 1 x lockable double pole 16-amp Circuit Breaker for each dispenser.
- Active and Neutral conductors shall both be switched.
- Populate the Switchboard with 1 x 4 pole lockable 20amp Circuit Breaker for the Gas System.
- All Active and neutral conductors shall be switched.
- Populate the switchboard with 4 x 2 pole lockable 16amp Circuit Breakers for other items.
- Label each circuit of the Switchboard with traffolytte or equivalent labels.
- Allow for 40% spare space for future needs.

### 2.2 Conduit and Cabling

#### Dispenser/Pump

Supply and install 1 x 1.5mm 10 core + Earth Orange Circular cable from the Fuel Switchboard to each dispenser/pump.

Each Cable shall be installed in 1 x 32mm NUPI or UPP Hazardous Locations Conduit.

Each cable shall be terminated at each end using Class 1 Zone Barrier Glands to match the NUPI or UPP Conduit.

Each Gland shall enter the termination box by way of approved and accredited Class 1 Zone 1 reducers VR2

Supply and install 2 core Beldon or similar shielded cable from dispenser/pump to management system.

Each Cable shall be installed in 1 x 32mm NUPI or UPP Hazardous Locations Conduit.

Each cable shall be terminated at each end using Class 1 Zone Barrier Glands to match the NUPI or UPP Conduit.

Each Gland shall enter the termination box by way of approved and accredited Class 1 Zone 1 reducers.

#### Tank Turret

##### Submersible Turbine Pump

Supply and install single or three phase wiring min 1.5mm as per STP's specified from pump motor to switch gear.

Each Cable shall be installed in 1 x 32mm NUPI or UPP Hazardous Locations Conduit.

Each cable shall be terminated at each end using Class 1 Zone Barrier Glands to match the NUPI or UPP Conduit.

Each Gland shall enter the termination box by way of approved and accredited Class 1 Zone 1 reducers PLLD

Where PLLD's are specified supply and install 2 core Shielded cable from PLLD TO management system. Each Cable shall be installed in 1 x 32mm NUPI or UPP Hazardous Locations Conduit.

Each cable shall be terminated at each end using Class 1 Zone Barrier Glands to match the NUPI or UPP Conduit.

Each Gland shall enter the termination box by way of approved and accredited Class 1 Zone 1 reducers.

### Spare Conduits

All spare conduits must have identification labels and be capped both ends.

### Automatic Tank Gauging

Where specified supply and install 2 core Beldon Shielded cable from ATG probe to management system.

Each Cable shall be installed in 1 x 32mm NUPI or UPP Hazardous Locations Conduit.

Each cable shall be terminated at each end using Class 1 Zone Barrier Glands to match the NUPI or UPP Conduit.

Each Gland shall enter the termination box by way of approved and accredited Class 1 Zone 1 reducers.

### Sensors

Where sump, turret or monitoring well sensors specified supply and install 2 core Shielded cable from ATG probe to management system.

Each Cable shall be installed in 1 x 32mm NUPI or UPP Hazardous Locations Conduit.

Each cable shall be terminated at each end using Class 1 Zone Barrier Glands to match the NUPI or UPP Conduit.

Each Gland shall enter the termination box by way of approved and accredited Class 1 Zone 1 reducers  
VR1-VR2 pressure sensors

VR1 and VR2 as required under the site specific scope of works a 32mm NUPI –UPP conduit shall be installed between the vent risers and the ATG console. Where VR1 and VR2 monitoring mandated a 2 core shielded cable is to be installed and connected to the sensor and ATG console.

### ATG Console

The installation and connection of the ATG console and associated equipment inside the building as per site specific specifications. The contract or shall ensure all associated equipment is installed and tested prior to fuel delivery.

### Communication Interconnection Box

Connect dispenser communications cable to Gilbarco Blue Box and label all dispensers.

Supply and install 1 x Cat 6 cable from Blue Box to console area and connect to console.



## Fuels Emergency Stop

The emergency stop shall isolate all active and neutral conductors to the Hazardous Location. The fuels emergency stop shall be "All Fuels Stop" where activated all fuel dispensing equipment including STP's Dispensers pumps and LPG system will be deactivated.

E Stop buttons placed external of the building shall be flameproof where installed in a hazardous zone and weatherproof where fastened to a building wall; Emergency Stops must have a cover on the push button so designed to eliminate accidental button activation.

E Stops as a minimum are to be installed in the following locations:

- 1 at console
- 1 in front of shop

## Static Earthing & Bonding

Supply and install 1 x 16mm Earth Cable to all metallic items with inside the Hazardous zone.

Attach these cables by way of 16mm crimp lugs.

All joints shall be either soldered or lugged. Cable shall be buried direct into the ground.

The earth cable shall terminate on its own earth stake which shall be located in the fill box.

Produce a signed test sheet showing that all static earth connections have a reading of less than 2 ohms

Bonding of all dispenser sumps/bases is required to any surrounding bollard or canopy column. This must be installed where new pumps and dispensers are installed on all driveways. The Installer must provide, in accordance with AS/NZS 1020 and AS/NZS 3000, static bonding connected to an appropriate earthing point at the fuel fill spill containment device or other suitable location. The static bonding as a minimum shall be connected to all tank fills and vapour recovery points, the tank dip risers and all submersible turbines as required to discharge static from the product stored in Jacketed Steel and FRP (Fibreglass) Tanks.

## Documentation & Certification

- All work must be inspected and signed off by a Hazardous Location Certified Electrical Inspector.
- Supply a copy of the Certified Prescribed Electrical Certificate.
- Supply a copy of an installation test sheet showing that each circuit has been tested. This test sheet shall include point to point testing, earth testing and an insulation resistance test for each core of each cable.
- The installation test sheet shall be signed and dated by the electrician that completed the tests.
- Supply a copy of the Hazardous Certification Certificates for all equipment installed in the Hazardous Zone. This shall include, conduit, glands, fittings and reducers.
- Supply a plan of all underground conduits and cables that are in the Hazardous Zone. This plan shall be labelled "As Built".
- Supply 1 x hard copy and 1 x soft copy of all documents to the Project Supervisor.

### 3 Decommissioning

All works will be carried out in compliance to all regulations, standards and acts in relation to removal and transportation of a vessel and equipment that has contained a flammable or combustible product and flammable/combustible liquids from site.

The contractor is responsible for the decommissioning including but not limited to: -

- Electrical disconnection.
- Removal of pumps/dispensers.
- Removal of all pipework.
- Removal and transportation of tanks
- Excavation verification and testing.
- Backfilling.

Decommissioning requires draining product from tanks & associated pipes, tank & pipe removal, vapour venting, labelling, disposal, treatment of abandoned tanks and backfilling. Decommissioning shall be conducted strictly in accordance with AS 4976.

For suction systems, the lines shall be disconnected from the tanks and drained into approved containers.

Air shall NOT to be used to blow out lines.

#### 3.1 Removal of Dispensing /pumping equipment

##### Dispenser/Pumps

The contractor is responsible for the safe removal of dispensing and pumping equipment including the electrical isolation (LOTO) at switchboard. Disconnection of connecting pipework including draining of remaining product into container. Note no product is to drain to ground. All supply piping including under dispenser/pump are to be plugged off.

##### STP'S

Pressure systems, all product lines are to be drained by removing the submersible turbines, check valves. Submersible turbine fittings are to be disconnected, any remaining product drained into approved containers.

##### Piping

Removal of piping is to be by "Cold Cutting" removal of piping by excavator is not permitted. All lines are to be drained back to the tank prior to piping removal. A temporary vent is to be installed during the removal of all piping. If any piping is to remain in the ground the pipe must be made inert and sealed both ends. A drawing with the location of the piping is to be supplied to the superintendent.

## 3.2 Tank Removal

### Removal of product

Tanks are to be emptied of all product prior to site works. Remaining product is to be removed from the storage tank by using a pneumatic pump electrical or diesel operated pumps are not permitted. All equipment used in the transfer of liquid must be bonded between tank and disposal equipment. Liquid is to be disposed of as per regulative requirements.

### Tank Removal

All removable fittings e.g. tank overfill valves, float valves, automatic tank gauges etc. shall be removed from the tank and all openings securely plugged.

A flame retardant vent fitting shall be maintained on all tankage at all times. All other openings shall be closed with a plug or a cap at all times except to effect product transfers.

‘Hot work’ is not permitted to the tank and in the vicinity of tank during its removal.

Excavate all around the tank and remove it from the ground by lifting on the lifting lugs. Care must be taken not to puncture or rupture the tank.

Lifting lugs attached to the tank shell shall be cleaned and visually inspected to ensure welds are sound and show no signs of corrosion or stress prior to lifting.

Any holes in the tank shell shall be sealed to prevent the loss of any sludge and to prevent ingress of air.

### Transportation of Tank

Transport shall be in full accordance with all road transport regulations applicable to the cartage of hazardous goods and applicable Codes of Practice.

The Contractor shall ensure that tanks removed must be transported from site same day.

The removal Contractor is responsible for preparing the removed tanks for freight from the site including removing backfill from tank shell and placing of signage on the tank as detailed below.

Transport shall be in accordance with AS 4976.

### Tank Disposal

Tank disposal is to be carried out in accordance with AS 4976.

Tanks are to be removed from site for destruction by an accredited tank destruction company. Contractors are to provide the superintendent with copies of destruction certificates.

### Abandoning of tanks in-situ

Tanks are not to be abandoned on site unless written approval is obtained from the superintendent. If approval has been obtained, tank abandonment is to be conducted in accordance with AS 4976 and / or State or Local requirements.

### Backfill

Prior to back fill of excavation an environmental site assessment may be required refer site specific requirements. Re use of existing soils only permitted where site specific scope specifies. Backfill materials must be clean and adequate for the compaction that is specified can be achieved.

## 4 TANK INSTALLATION

### 4.1 Excavation

All installation work is to be carried out in accordance with the latest literature from the tank manufacturer. If this specification conflicts with that literature, the tank manufacturers' guide will be the overruling document, to maintain the installation warranty. Any conflict should be brought to the attention of the Superintendent.

The Contractor will complete all relevant documents and certificates of testing and inspection as necessary to the Manufacturers requirements to ensure warranty compliance and supply them to the Superintendent upon completion.

Location and finished levels are to be verified by the Contractor and confirmed with the Superintendent before excavation commences.

Excavation to be carried out in strict accordance with all statutory regulations. Any temporary barricade, shoring for unstable ground, pumping equipment for water charged excavation that is necessary for the completion of the excavation is to be supplied by the Contractor.

Excavation shall be dimensioned to allow for the tanks to be installed strictly in accordance with the manufacturer's instructions.

Where geotechnical recommendations suggest shoring for tank excavations, the Contractor shall engage qualified engineers to design the shoring system.

Tank cover shall be as nominated on the Fuel drawings but shall have a minimum cover of;

- 1200mm to the underside level of the driveway for a pressure fuel delivery system, and
- 600mm minimum cover for a suction delivery fuel system (no tank turret).

The excavation shall be taken down plumb, true to the given dimensions and be graded to the monitoring well location(s).

Installation shall include excavation to suit existing ground conditions and in compliance to work cover regulative requirements and to include all necessary bedding and packing, crane hire, anchoring, temporary water ballast, removal of same. All installation work is to be carried out by installers holding a current Installation Certificate for the tank manufacturer.

### Contaminated Soil Removal

Contaminated soil must be legally disposed of. All costs associated with contaminated soil disposal are to be borne by the Contractor.

### 4.2 Tank Handling and Responsibilities

The tank manufacturer is responsible for the loading of the tank(s), the delivery, ensuring that the vehicle is equipped with approved transportation equipment and delivery to site. If the tank installer is required to deliver the tank(s) he shall provide a vehicle and transportation equipment to satisfy the tank manufacturer.

It is the tank installer's responsibility to inspect the delivered tank(s) on site prior to installation and report on manufacturer's form any damage to the Superintendent. Any damage to the tank(s) shall be reported to the tank manufacturer **immediately** to assess the damage and advice on appropriate rectification. In any event, damage is to be made good by the tank manufacturer prior to installation and a written certificate shall be issued by the tank manufacturer for all tanks in accordance with their warrantee. No works are to proceed until approval from the superintendent is obtained.

Tanks shall only be lifted with an appropriately sized crane. **Lifting with a backhoe or excavator is not permitted.** During lifting onto and from the transport the lifting lugs supplied on the tank must be used. Lifting chains or straps shall be so arranged so as to be at an angle of no more than 30 degrees to the vertical to avoid undue axial stress on the tank shell. The tank manufacturers' guidelines for tank handling are to be adhered to at all times. Guide ropes shall be attached to each end of the tank and manned during lifting and placement.

#### 4.3 Geotextile

Geotextile fabric shall be placed around the tank excavation either if recommended in the Geotechnical Report or where there is a likelihood of surrounding ground migrating through the tank backfill material. Where geotextile fabric is used, sheet overlap shall be 300 mm (min).

#### 4.4 Tank Bedding Placement

Tank anchors and backfill materials as per tank manufacturer's specifications shall be placed on the floor of the excavation and levelled. All appropriate tank strap connection points shall be positioned to correctly correspond with the marked reinforcement ribs on the tanks. Special attention is to be given to possible confined space entry to excavation all relevant laws and codes are to be adhered to for excavation entry.

#### 4.5 Placement and Levelling

The tank shall be placed into the excavation and approved backfill shall be placed at the ends and under the sides of the tank to stabilise the tank temporarily whilst levelling is carried out. Tanks shall be levelled in the horizontal plane and dip / fills plumbed in the vertical plane.

#### 4.6 Anchoring

Tanks must be strapped down using tank manufacturer supplied anchors and straps as detailed on the standard Tank Installation Drawing. Anchoring must be completed as per the Tank Manufacturer latest written instruction and must comply with the Manufacturer's warranty conditions.

#### 4.7 Tank Pit Monitoring Wells

The specification covers the supply and installation of monitoring wells for tank pits. The wells are to be permanently installed in the excavated pit after tanks are installed and before back filling has commenced. Nominal depth of 4000mm to 4500mm from base of tank pit to finished pavement level.

Materials for use in monitoring wells will be of the following standard:

- 100mm diameter monitoring well - 5 metres long (slotted pipe)
- 100mm PVC cap (bottom) and 100mm locking cap (top)
- 200mm cover and access ground box with international symbol and signage

Installation of Monitoring Well:

- Wells do not require outer filter material. Ensure that the backfill is located at the base of the monitoring well.
- Caps are attached to the bottom of well screen. Well screens are to be screwed together. Glued or welded solvent joints are not to be used. Well screen is then lowered into casing in a vertical position.
- Well screen should be cut so that it projects above finished concrete level.
- As tank pit is backfilled well screen should be checked for level to ensure that it is in the vertical position.
- Before driveway is poured, well screen is cut 100mm below finished driveway level.

- Ground box and cover are to be installed over well screen so that cover is mounted in the concrete 25mm above finished surface and access to well for monitoring is not impeded.

#### 4.8 Back Filling of Tanks

Once the tie down procedure is complete the contractor shall backfill level to top of tanks. Great care must be taken not to damage the tanks in any way. If the tanks are impacted in any way, the incident shall be reported immediately to the Superintendent who will arrange inspection and repair if required. The costs of inspection, repair, testing and any resulting project delays shall be met by the Contractor. The Contractor must ensure that the back fill is worked under the sides of the tanks to provide adequate support and complies with the tank manufacturers backfill requirements.

All tank opening shall have the tank manufacturers plastic plugs removed and replaced with gal malleable plugs to eliminate entry into tank of backfill materials. **The tank must remain vented.**

#### 4.9 Monitoring of Tank Prior Final Backfill

The contractor shall monitor the tank interstitial space monitoring system (Hydroguard) during and up to final backfill for change of level. The superintendent must be contacted immediately if level changes more than manufacturer's specifications. **The tank must remain vented.**

#### 4.10 Final Back Fill

When all fuel system piping and electrical conduits installed and tested, the final layer of backfill above the tanks to the underside of the pavement can be placed. This layer must be placed carefully to prevent damage to tanks or pipework and meet compaction requirements specified by the relevant manufacturer. Contractor must provide barricades to the area to prevent unauthorised disturbances by others, particularly ensuring that no large machinery is driven over the tanks/lines area.

#### 4.11 Tank Ballast

Where possible the tank should be installed in a dry excavation. For dry works where the tank is back filled only to the top of the tank, water ballast must be added as per tank manufacturer's installation procedure. It should be noted that ballast will be required for hydrostatic testing **after backfilling is completed.** The Contractor is responsible for the supply and removal of water for ballast. For wet excavations the tanks should be placed in the excavation and sufficient ballast should be added only to sink the tank. The level of ballast must never exceed the level of water in the excavation. Once placement of backfill to the top of the tank is completed the tank ballast should be completed. Tank ballast is to remain until completion of finished ground surface above the tank and to be left completely full to facilitate tank testing.

## 5 Pipework

Pipework shall be proprietary type as nominated. Approved proprietary Polyethylene piping systems are UPP, NUPI & Durapipe. All piping, proprietary type. Galvanised steel or fibreglass pipework is NOT to be used on new installations or “re-tank or re-pipe” of fuel systems. All Polyethylene piping shall be installed with tracer tape

Piping is to be examined before use to ensure no damage Care shall be taken during installation to prevent the inclusion of foreign matter in the bore. All open ends and fittings must be blocked off whilst work is not actually being carried out on that section of the installation. For galvanised steel pipe risers use a screwed cap or plug. For proprietary type pipe, ensure that protective end caps are left in place until jointing is ready to be carried out.

Any piping showing internal dirt or foreign matter shall be thoroughly cleaned. On no account is rag or similar material to be used.

Where specifically noted on the Drawings, the Contractor shall run and blank off additional/spare piping, conduits and other as required.

All underground pipework below trafficable areas shall be 600mm where practical minimum below finished ground or concrete level where practical excepting pipe work associated with underground tanks. This would include water and air lines, electrical conduit, mains power, mains water, drainage etc.

### 5.1 Steel Piping

Galvanised steel pipe work and fittings are only to be used on vent pipes, dip, dewater, ATG, hydroguard risers and connections within tank man ways. All exposed galvanised steel fittings must be wrapped with Denso 600 Petrolatum base tape with 55% overlap and over wrapped with Denso 931 self-adhesive tape with 55% overlap in accordance with the manufacturers written instructions. Fittings should be left unwrapped until all line testing and inspection is complete. This includes the swing joints and the buried sections of the steel vent risers but does not include the flex couplings to the submersible turbine pumps and dispensers.

#### Joints

A minimum of joints shall be used and long lengths of pipe employed wherever possible. Fabrication of each line shall commence at the tank fitting on new work and from the closest point to the tank for pipelines extension.

All joints shall be carefully made with a good quality B.S.P. taper thread, tightly assembled in a clean and true manner. No socket fittings with parallel threads can be used for jointing of pipe lengths.

All joints, unless otherwise specified shall be with Loctite or Megapoxy spread evenly on male thread only, care being taken that none is allowed to enter the pipe bore during assembly.

All traces of lubricant or cutting oil shall be removed from threads before making joints. Dies shall be adjusted so that all shall have not less than eight (8) threads engaged, and shall tighten hard on the taper of the thread leaving three (3) free of engagement.

Where flanged valves are used in the pipeline, the connecting thread on the pipe shall be cut to a length where a thread tight joint is obtained before the end of the pipe bottom on the valve body.

Joints made with unions shall be closely examined to ensure that good even contact is made over each face and the faces are free from imperfections.

**Running Threads shall not be used.**

## 5.2 Pipework Trenching

All pipework trenching shall be backfilled with materials in accordance with pipe manufacturers written instructions after final inspection and pressure testing. Compacted carefully over and around the piping system using suitable tamping equipment. Bags filled with approved backfill material must be used for support as required to ensure that all pipes are installed in straight lines and uniform grades without sags including during the course of back filling operations. If the above is not complied with all costs associated with any remedial work that may be required shall be met by the Contractor.

## 5.3 Pressure Lines

Product pressurised pipelines are to be proprietary system pipework as nominated on the drawings and installed in accordance with manufacturers written specification and laid as shown on the plans. All pressurised product lines are to be secondary contained. Product lines shall have a minimum fall of 1:100 back to the tank, with a minimum cover in accordance with manufacturer's recommendations. This fall shall be continuous and not subject to sudden changes of gradient. Ensure that all pipes and fittings are free of all foreign material prior to assembling. Pipelines shall be kept as short as practicable in all cases, with the number of changes of direction kept to the absolute minimum.

No joins of pressure lines outside of containment sumps are allowed.

Pipework shall be laid so that it does not cross other tank fittings or lines under dispensers unless required. Pressure piping shall terminate inside the tank turret to the Pressure Pump, using a flexible fitting and ball valve passing through the wall of the tank turret to the dispenser.

### Under Dispenser

All pressure piping must terminate inside a dispenser containment sump. Pressure piping shall terminate at the under dispenser ball and impact valve and passing through the containment sump shall be sealed with a piping seal boot. Single poppet impact shear valves are required under every dispenser associated with either a pressure or submersible pumping system. To operate correctly in the event of an impact the shear plane must be installed at the same level as the base of the dispenser. Also the entire valve must be securely anchored to the dispenser base with the mounting bolts supplied.

## 5.4 Suction Lines

Product suction pipelines are to be proprietary system pipework as nominated on the drawings and installed in accordance with manufacturers written specification and laid as shown on the plans. All suction product lines are to be 63mm secondary contained lined pipe. Product lines shall have a minimum fall of 1:100 back to the tank, with a minimum cover in accordance with manufacturer's recommendations. This fall shall be continuous and not subject to sudden changes of gradient Pipelines shall be kept as short as practicable in all cases, with the number of changes of direction kept to the absolute minimum.

Ensure that all pipes and fittings are free of all foreign material prior to assembling.

Pipework shall be laid so that it does not cross other tank fittings or lines under pumps unless required. Suction piping on the tank man-way lid shall include a suction valve (poppet removed) suction tube and suction stub. The suction stub must not pull from the bottom of the tank and be a minimum 150mm from tank bottom. piping shall be passing through the wall of the tank turret to pump shall have a flanged joint outside of the tank man-way lid but contained within the tank turret All piping passing through the tank turret wall shall be sealed with a piping boot.

Where a suction system is outside a tank turret, the poppet within the valve poppet must be removed. In any event, access to this poppet must be provided through a 250mm riser to finished pavement levels.



## Under Pump

Suction piping shall terminate at the under pump non return valve and where containment sump exists passing shall be sealed with a piping seal boot.

### 5.5 Fills

Remote fill lines are to be 100NB proprietary system pipe as indicated, laid with a continuous fall of 1:100 back to the tank, with minimum cover as recommended by pipe manufacturer to finished surface levels.

Ensure that all pipes and fittings are free of all foreign material prior to assembling.

Galvanised steel pipe is to be used as the fill pipe risers, with connection for each fill line by means of a proprietary elbow adaptor and the steel risers.

Fill piping on the tank man-way lid shall include a product isolation valve and internal fill tube c/w with an equalizing hole. The fill piping shall be passing through the wall of the tank turret to pump shall have a flanged joint outside of the tank man-way lid but contained within the tank turret. All piping passing through the tank turret wall shall be sealed with a piping boot. All fill piping shall be installed to allow for expansion as per manufactures specification e.g. change of direction every 12m.

All fill piping must be installed with a mechanical overfill protection device which can be removed for maintenance or testing.

Steel tanks a product isolation valve is to be installed and piping is to be direct connected. No flanges are to be buried.

## Overfill Prevention

~~All tank mounted vent line extractor fittings shall have ball float overfill prevention valves fitted. These valves are to be installed in accordance with the manufacturer's instructions and must be fitted such that they are closed when the tank reaches the 97% product level.~~

**Only** fill line overfill prevention valves are to be fitted. Fill line overfill prevention valves must be installed strictly in accordance with the manufacturer's instructions, and are to shut down to reduced fuel inflow at the tank 95% product level.

## Fill Point

All fill points and dispensers shall be provided with a spill containment of an approved manufacture. The type and location of the fittings shall be in accordance with the drawings.

Fill piping is to terminate in a fill box that is to be secondary contained with individual containment for each fill line holding 15 litres of fuel and capability with drain back to the fill line. Fill line is to terminate inside fill containment box with a 100mm fill adaptor and cap. Tank ID number and product are to be fastened to the fill box dust cover lid of each compartment as well as "on ground" adjacent to fill box compartment on the truck side of the fill box lid.

At the fill point the galvanised steel riser pipe(s) shall be sealed to the spill containment box which shall be earthed. The earthing stakes shall be stainless steel construction and sized to suit the site conditions.

## 5.6 Vents

Air vent pipelines are to be either 63NB, 90NB proprietary type pipe as indicated, laid with a continuous minimum fall of 1:100 back to the tank with a minimum cover as recommended by pipe manufacturer to finished levels. Connection to the tank is by an extractor vent valve assembly, **float valves are not to be installed**. All vent piping leading from the tank top man-way shall have a flanged joint outside of the tank man-way lid but contained within the tank chamber. All piping passing through the Tank Chamber Wall shall be sealed with a piping seal. No flanges are to be buried.

**Note:** Vents shall be sized and located strictly as per the relevant statutory requirements, particularly in relation to proximity to building openings, flue outlets, and lateral distance from electrical equipment and/or fittings. **Refer to AS1940 to adequately size per tank.**

Vents shall terminate with polyethylene piping to gal steel risers. Where gal steel risers are below ground the riser must be wrapped with Denso 600 Petrolatum base tape with 55% overlap and over wrapped with Denso 931 self-adhesive tape with 55% overlap in accordance with the manufacturers written instructions.

The vent riser must terminate minimum of 4.0 metres above ground level all vent risers are to be adequately supported to suit the area of installation. Note in cyclonic zones additional support may be required.

Vent risers are to terminate with a “to atmosphere” vent cap where specified.

## 5.7 Vapour Recovery 1

Vapour recovery pipelines are to be 90NB proprietary type pipe as indicated, laid with a continuous minimum fall of 1:100 back to the tank with a minimum cover as recommended by pipe manufacturer to finished levels.

Vapour recovery is to be connected to all Motor Spirit. Vapour recovery 1 **is not** to be connected to any Diesel tank. VR1 is connected to the tank socket via a vapour-vent cross Note: VR1 is connected to the ullage of tanks, no connection to internal tubes/pipes. VR piping from the tank top man-way shall have a flanged joint outside of the tank man-way lid but contained within the tank chamber

Where no tank chamber exists the VR2 piping shall direct couple to the vapour –vent cross

No flanges are to be buried. The VR1 riser must terminate minimum of 4.0 metres above ground level and adequately supported to suit the area of installation. Note in cyclonic zones additional support may be required. Vent risers are to terminate with a “to atmosphere” vent cap where specified.

**Where VR1 is mandated the risers shall terminate to an atmosphere vent cap or as approved by regulations.**

## Vapour Recovery Truck Connection Point

The vapour recovery line shall terminate at the truck connection point at the fill box location and shall be incorporated into the remote fill / spill box or separate VR / spill container. The location of the VR connection is to be for connection to the rear of the tanker.

The vapour recovery line termination shall include a 75 mm NB galvanised steel riser, 75 mm bronze vapour swivel adaptor and side seal vapour cap.

## 5.8 Vapour Recovery 2

Vapour recovery 2 provisions must be installed on every site. Where appropriate under state legislation and/or any planning/building permits, VR2 must be commissioned and operational.

Vapour recovery 2 pipelines are to be 63NB - 90NB proprietary type pipe as indicated, laid with a continuous minimum fall of 1:100 back to the same tank as vapour recovery 1 connection with a minimum cover as recommended by pipe manufacturer to finished levels. Vapour recovery 2 is **not** to be connected to any Diesel tank.

VR2 is connected to the tank socket via a vapour-vent cross Note: VR1 is connected to the ullage of tanks, no connection to internal tubes/pipes. VR piping from the tank top man-way shall have a flanged joint outside of the tank man-way lid but contained within the tank chamber. Where no tank chamber exists the VR2 piping shall direct couple to the vapour –vent cross. No flanges are to be buried.

Where VR2 is mandated the risers shall terminate to an atmosphere vent cap with 10mm orifice and pressure vent cap or as approved by regulations.

## 5.9 Pump/Dispenser Bases

Pump bases shall be supplied as an integral part of the under pump/dispenser containment sump.

Unpainted mounting bases shall be thoroughly cleaned using a wire brush and given two prime coats of red oxide zinc chromate or similar zinc rich paint.

Pump/dispenser containment sumps are to be 20mm above finished pavement level so as to eliminate water flow through sumps. Sealant suitable for hydrocarbons is to be used between the pump/dispenser base and the sump base.

## 6 Tank Top Fittings

Surrounds around all plugs are to be cleaned free of dirt before removing plugs. Gal malleable plugs are to be used where tank sockets are not used.

### 6.1 Dip pipe

All dip pipes shall be 100mm Galvanised Steel denso wrapped and terminated at ground level with a lockable cap.

Dip pipes fibreglass tanks are to be fitted with internal tubes with an equalizing hole. All dip tubes are to be 100mm minimum from tank bottom.

Dip pipes steel tanks are to be fitted to a socket with an internal tube. If no socket is available with an internal tube a dip tube shall be installed as per fibreglass tanks.

All dip pipes shall contain a calibrated alloy dip stick as supplied by the tank manufacturer.

All dip riser pipes shall be contained at ground level within a 300mm lockable steel lid ground box.

On ground dip markers with product identification and tank numbers are to be fastened to the ground adjacent to the dip point.

### 6.2 ATG riser pipe

All ATG riser pipes shall be 80mm Galvanised Steel denso wrapped terminated with a cam lockable cap. All ATG riser pipes outside a turret shall be contained at ground level within a 300mm lockable steel lid ground box.

### 6.3 Tank Hydro-guard riser pipe

All Hydroguard riser pipes shall be 100mm Galvanised Steel denso wrapped terminated with a 100mm cam lockable cap. A breather hole is to be installed as per manufacturer's specifications.

All HG riser pipes shall be contained at ground level within a 300mm lockable steel lid ground box.

## 7 Fittings List

Item	Description
Dip & Fill	100 NB galvanised steel pipe (Denso wrapped)
Lock Boxes	300mm diameter captive steel lid (Shipman King)
Spill containment fill boxes	Secondary contained with individual containment per fill point min storage 15 litre.
Dip and Fill Cap	F-734 Cap & F-727 Adaptor (Shipman King)
Remote Fill Pipe	Proprietary pipework system with galvanised steel riser to fill box
Tank Sumps	Tank manufacturer or equivalent approved equivalent suitable to the specified proprietary pipework system
Dispenser/pump sump	Shipman King or equivalent.
Remote fill pipe test fitting	100NB Eskay F1075 DTM or equivalent.
Overfill protection	Guardian ,OPW Shipman King.
Tank Valves	50 or 80mm as indicated Eskay with patented poppet, V-TT50V or equivalent.
Suction Stubs	Eskay ST50 for 50mm suction stubs
Check Valves below pump 50mm	offset valve (Eskay or equivalent) or tri- valve
Elbows, Tees	Proprietary type to match pipework system except galvanised steel elbows to STP and steel vent riser
Pipework Fittings	Proprietary type to match pipework system or galvanised to match existing system
Line Valves	Shipman King ball valve to line size with Teflon seat or equivalent
Sockets, Reducing Sockets etc.	Proprietary type to match pipework system
Plugs	Malleable galvanised
Reducing Bushes	Galvanised steel or proprietary type to match pipework system
Unions	Galvanised with brass seatings for galvanised pipe
Product Lines	50NB, 80NB or 100NB proprietary system pipe as indicated on drawings

Extractor Vent Valve	Shipman King, V620
Vapour Recovery Adaptor	80NB Eskay 611V vapour recovery adaptor with 733 VC cap

## 8 Fuel System Integrity Test

All testing methods are to be approved by the Superintendent prior to commencement.

Testing of the system will be carried out in three stages. Firstly, the product delivery pipe system after completion, separate from the tanks to ensure its integrity at operating pressure and to maintain an integrity test until completely back filled. Secondly the tank, fill, dip, vapour and vent lines shall be hydrostatically tested guarantee their integrity. Thirdly after all back filling and concrete operations and just prior to commissioning, the lines and tanks shall be precision tested and certified. These three tests are detailed below.

The first two tests shall be witnessed by the Superintendent, who will make a record of the results.

### 8.1 Delivery and Fill Line Testing

Once complete, new delivery and fill lines shall be tested by pressurised air and all joints checked using soapy water. For pressure systems the lines shall be completely isolated from the tanks but shall include ball valves and flex connectors. For suction systems the tank valves should be removed and an isolating valve fitted to the tank valve body, this valve should be shut tightly to isolate the pipe pressure from the **vented** tank. All lines must be tested back to the dispenser / pump to include all the under dispenser joints (i.e. shear valves under dispensers should be left open).

**CAUTION: Tanks must be vented at all times to avoid excessive pressure being applied to the tanks.**

The lines shall hold pressure for a minimum of 30 minutes to be accepted as sound. All lines shall be tested to **350 kPa**. The pressure gauge used for the above test shall have a maximum scale reading of 500 kPa.

**Note: This high pressure test must be witnessed by the Superintendent.**

Upon completion of the high pressure tests, all delivery lines should be fitted with two new 0 - 100 kPa pressure gauges and pressurised to 50 kPa. These gauges must be readily visible and checked every day during construction.

The pressure will fluctuate with temperature and should be relieved during hot weather if it exceeds 90 kPa. Should gauges record different readings then they shall both be replaced with new gauges.

The gauge reading shall be logged in the foreman's site diary on a daily basis and by the Superintendent on each visit. System depressurising, and gauge removal shall be witnessed by the Superintendent.

### 8.2 Initial Tank, Siphon, Fill, Dip, Vapour and Vent Line Testing

After all, pipe work including fill, dip, siphon, vapour and vent lines have been installed the tank and lines shall be subject to a hydrostatic test.

The tank shall be filled to a maximum safe fill level at least 12 hours before the test is scheduled.

All unused tank sockets shall be plugged. The Product Distribution lines will still be pressurised from the previous test. The water level in the dip pipe shall be raised to the top of the dip pipe. Fill, vapour or vent lines must not be capped whilst filling the system with water to allow air to escape. Once the system is full, fill point caps can be replaced.

**Note:** If the remote fill point is physically located above the top of the dip tube, the fill point can be used as the monitoring point.

**CAUTION:** The pressure on the bottom of the tanks should not exceed 45 kPa.

The level in the standpipe shall be observed for 60 minutes. During this time all tank and line fittings shall be inspected.

**Note:** This test must be observed by the Superintendent.

If there is an apparent loss the amount shall be determined by the volume that must be added to restore the standpipe to the original level.

This shall be repeated until consistent results are achieved.

A consistent loss of more than 200ml in 30 minutes or any observed leak shall be taken to indicate that the system is leaking and the following steps shall be taken.

If leaks are visible, then rectification work shall be taken at the source. If leaks are not visible, then the standpipe level shall be lowered to 100mm above the tank shell and observed again. If all other possible sources of leaks have been eliminated immediate arrangements must be made to precision test the tank.

Upon completion of this test, the standpipe is to be left in-situ and observed daily until just prior to commissioning. The top of the standpipe must not be more than 4.5m above the bottom of the tank and must not be capped, to allow for thermal expansion and contraction of the water in the tank.

### 8.3 Tank Turret Riser Testing

After all, pipe work and electrical conduits have been fitted through manhole risers, the riser shall be filled with water and checked for leaks.

All boots and entry points to riser shall be sealed with an appropriate sealant so as to be water tight. The water in the manhole riser shall be observed for sixty minutes. All leaks shall be repaired and then tested again.

### 8.4 Under Dispenser /Pump Sump Testing

After all, pipe work and electrical conduits have been fitted through the containment sumps, the sump shall be filled with water and checked for leaks.

All boots and entry points to the sump shall be sealed with an appropriate sealant so as to be water tight. The water in the sump shall be observed for sixty minutes. All leaks shall be repaired and then tested again.

### 8.5 Final System Precision Testing

After all concrete and earthworks are complete but prior to the removal of ballast from the tanks, all tanks and lines shall be precision tested. This test may take typically one day for each tank. The Contractor shall give 5 days' notice in writing of when the testing shall take place, so that the Superintendent may witness the test.

For pressure systems only, the distribution line shall temporarily connect to the tank socket. The connection shall incorporate the ball valve, flex connector and a temporary "make up" pipe in place of the submersible turbine pump. This will allow the distribution lines to be included in the precision system test. Suction line tank valves should be reinstalled prior to testing for the same reason.

Unless otherwise approved in writing by the superintendent, all precision tests must be carried out by Leighton O'Brien.

This testing must prove the system before any product can be introduced into the tanks.

**Note:** Any costs associated with repairing leaks, verifying repairs by precision testing and any reasonable costs associated with delays in schedule shall be borne by the Contractor.



## 9 Monitoring System

### 9.1 ATG console

The console is to be positioned adjacent to the fuels system distribution board or as specified in site specific documentation.

The ATG **is not** to be wired to emergency stop circuit—that is, on activation of the emergency stop, ATG is to remain powered and direct wired to the main board.

### 9.2 Tank Probes

ATG probes are to be install in each tank ensuring correct float for that product is installed. Probes are to be installed once water ballast is removed and prior to fuel delivery

### 9.3 Pressure Line Leak Detector

Where PLLD's are fitted they shall be connected to the ATG a test of the PLLD is to be carried out prior to dispensing of fuels to be conducted prior to dispensing of fuel.

## 10 Submersible Turbine Pump

All submersible turbine pumps must be supplied and installed in combination with either mechanical or electronic line leak detection. Any electronic line leak detectors installed must have appropriate SAA electrical approvals for the hazardous zone in which they are installed.

Common product systems with manifolded multiple pumps require a mechanical line leak detector on every pump or electronic line leak detection installed to detect leaks anywhere in the entire piping system between the pumps and the dispensers.

The Contractor is to make up pump column and riser stub(s) to provide **minimum** clearances of 150mm from the tank bottom to the pump intake and an 80mm minimum from the containment cover to the top of the Mechanical or Electronic Leak Detector.

Big Flo pumps (3HP & 5HP) are to be installed in 150mm diameter tank nozzles as indicated on the drawings. All other submersible turbine pump models are to be installed in 100mm diameter tank nozzles as indicated on the drawings. All pumps are to be installed and commissioned in accordance with the latest manufacturer's literature. Siphon systems are to be accurately installed as detailed on the drawings to ensure proper operation and maintenance of the siphon system.

**Note:** Submersible pumps shall not be submerged in water. Ensure all water ballast has been removed from the tank prior to installation.

Mechanical or Electronic leak detectors shall be fitted immediately after priming the lines and prior to commissioning and calibrating the system. The Contractor is responsible for commissioning the leak detection system.

Line leak detector test ports are to be fitted to shear valves located under each dispenser at the end of each product run.

## 11 Forecourt Dispensers and Pumps

### PUMP/DISPENSER INSTALLATION

New Units:

Dispensers shall be inspected on arrival for any surface damage, missing fittings and incorrect dressings. Serial numbers shall be taken and forwarded to the Principal for verification of site correctness.

All pumps and dispensers shall have galvanised plugs inserted to prevent any possible spillage. Contractor is responsible for safe keeping of dispensers once delivery accepted.

Dispensers shall be protected on receipt from supplier to final hand over to the Principal. Dispensers shall be completely wrapped in plastic to prevent damage to exterior surface during the construction period. Special care is to be taken to guard against cement splashes while concreting adjacent to the dispenser.

Pump/Dispensers are to be securely bolted down to the prepared sumps or bases. Alignment, level and plumb lines are to be checked. Any discrepancy is to be corrected by the use of metal packers. Under no circumstances should wood or similar material be used as packers.

Dispensers are to be checked for proper dressing and connected to the correct grade of fuel.

## 12 Commissioning

The Contractor shall be responsible to ensure that all lines and tanks associated with the site works have been properly installed and tested.

The Contractor shall be responsible to double check that all pumps have been installed level, adequately bolted down, pipe joints beneath the pump properly completed, and all electrical cables and connections to the pumps properly installed and tested.

The leak detection system shall be commissioned and test results in accordance with manufacturer's instructions shall be provided to the Superintendent. The leak detection system shall be installed prior to commissioning the submersible turbine pumps.

The Contractor shall achieve liquid prime to all pumps and run and flush the pumps and meters to observe and correct any electrical or mechanical malfunctions.

In summary, the Contractor shall be responsible to leave the site only after all equipment has been brought up to full operating condition and the pumps have had meter calibration and final commissioning. The pump manufacturer is to witness and test as independently necessary to ensure all warranty conditions are met.

## 12.1 Acceptance of Product

Acceptance of product is normally the responsibility of the Principal / Superintendent.

Product will not be delivered unless a third party integrity test report with a pass in all fuel system piping and tank has been issued to the superintendent.

The Contractor shall give a minimum of two (2) weeks' notice to the Superintendent to arrange the delivery of product to the site. The Contractor is required to ensure all water ballast is removed from the tanks prior to delivery and is to be present to ensure that the right product is delivered into the tanks.

Immediately prior to product delivery, the Contractor shall give notice that all tanks and lines are clean and prepared. The Contractor is to check the dipstick as to the compatibility with the tank for calibration and length. On receipt of the product all tanks are to be re-checked for water. This is to be removed before any further action is taken. The dispenser filters must be cleared of any foreign matter. Supply and install disc driveway markers, to all dip, fill and vapour recovery points using adhesive and expanding masonry anchors.

### Initial delivery procedure

The contractor is to prior to delivery into tank ensure the ATG console is operational.

Unload 500 litres of fuel to tank, stop delivery. Check the tank the fill line is connected and verify correct product and quantity check ATG console for corresponding product volume when it is certain that the right tank has taken delivery complete fuel transfer. Proceed through all tanks on site.

## 12.2 Submersible Pump Start Up

Prior to installation of mechanical leak detector or PLLD the contractor is to prime the line of product to eliminate residual air. The contractor during priming is to have the tank turrets open at frequent intervals check the pressure system within the turret for any leaks. Once air has been dispersed installation of the mechanical –PLLD is to be carried out.

## 12.3 Dispensers/Pumps

Each pump or dispenser is to have minimum of 500 litres circulated (back to tank), for checking meter/money readout variations after which the strainers in the pump/dispenser must be cleaned.

Measurement testing for volume in a certified container is to be carried out on each pump dispenser by the calibrating authority or licensed installer. Pumps are to be adjusted to be within the tolerance allowed by the relevant State authority. All pump dispensers are to be left in a clean and tidy condition on completion. Each hose is to be numbered to coincide with an agreed numbering system. Numbers are to be black numerals on white background decals.

## 13 Hand over Documentation

All documentation in relation to environmental assessments verifications, fuel system integrity testing, calibration documentation, operational manuals are to be supplied to the superintendent. The tank manufacturer's installation check list is to be returned to the superintendent for issue to the manufacturer.

### As Built Drawings and Photos

The Contractor shall enter any changes, alterations, underground or hidden features on the set of drawings which the contractor is required to keep on the site at all times throughout the course of the job. On completion of the works this set of drawings shall be presented to the Superintendent, covering all works under the Contractor's control.

These shall stipulate but not be limited to:

- All new equipment and pipelines.
- The existence of any underground services exposed during works which were previously unmarked on the supplied drawing.
- A general description of ground conditions, eg. clay, high water table, sand, gravel, rock, etc.

All drawings to be accompanied by photos on-site including landmarks to easily identify pipe runs

**Note: Final invoices shall not be approved for payment until "as built" drafts are received.**

