LIQUIP SALES PTY LIMITED
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DATE: **22 JANUARY 2002**

TO: **ALL LIQUIP DISTRIBUTORS — DOMESTIC & EXPORT**

FROM: **DAVID GREGORY, ENGINEERING MANAGER**

TECH TALK NO. 37

SEE TECH TALK 46 FOR VEHICLE WIRING, INCLUDED HERE IN APPENDIX 1

Reference: Installation of Electronic Equipment on Vehicles for Waterproofing and Mechanical Protection.

Attached: is a guide for correct installation of electronic equipment on vehicles.

This guide is concerned mainly with WATERPROOFING and MECHANICAL PROTECTION but do not ignore the usual safety requirements and common-sense considerations such as siting of the equipment in sheltered positions.

Why is this guide necessary?

The greatest causes of failure of vehicle electronics are poor wiring and moisture (Sources: Liquip, Scully and Civacon).

All equipment is designed in detail to be essentially waterproof: for example, EMH500 can be submerged to two metres depth of water. Yet installers have fitted it to vehicles with wiring going into open ports with no protection or sealing at all.

This is not just careless, it is criminal. Not only are you well on the way to destroying thousands of dollars worth of equipment, you are also destroying the reputation and future sales of those articles. The buyer doesn't care about the detail, "THAT MODEL" is no bloody good.

GOOD WIRING IS NOT AN OPTION — IT'S MANDATORY.

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Requirements: All 'outdoor' mounted equipment such as junction boxes and conduit to be minimum:-

* IP66 weatherproof. (Completely dust-proof, and protected against strong jets of water from all directions with minimal ingress permitted). IP68 (dustproof and waterproof) is preferred.

* Temp range –40ºC to +70ºC minimum.

* U-V resistant.

* Petroleum resistant.

If it is necessary to fit any hardware that cannot be sourced to these standards, it must be mounted in a properly sheltered area to prevent direct rain or wash impingement.

Note:

1 that none of the "hosetail-and-clamp" fittings meet IP66.

2 that threaded ports are essential on housings and junction boxes to achieve IP66. Through-hole-with-locknut-inside box do not in general survive the vibration and shock loads on mobile equipment.

3 improper installation is also a safety hazard and can contravene Safe Load Pass standards.

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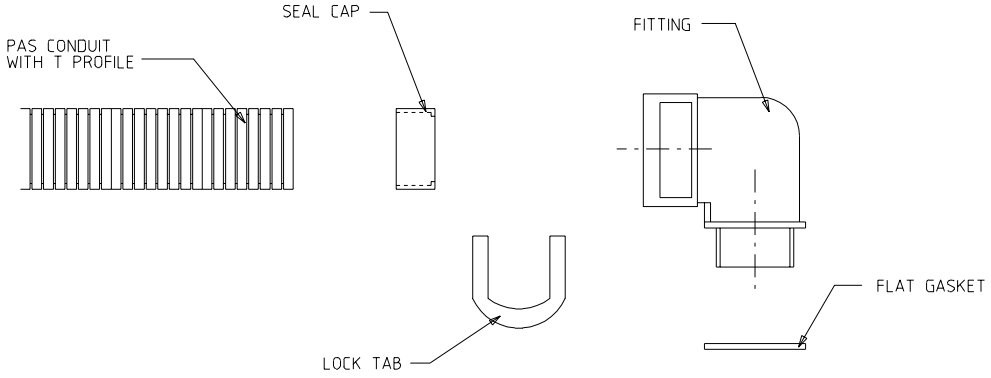
TYPICAL CONDUIT

PMAFLEX is a product we have used for many years in arduous conditions such as mine sites, and it is distributed in many countries.

Type PAS is tolerant to petroleum fuels and temperatures from –40ºC to +100ºC. Order as suffix "U" for U-V resistance (see example later).

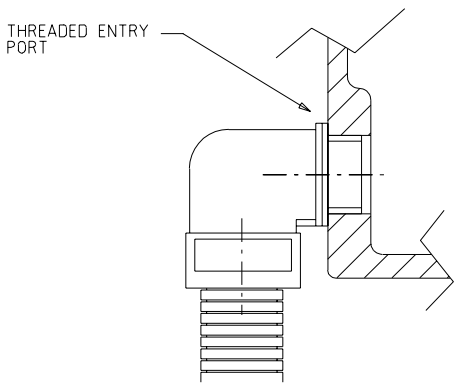
Sizes available are from 6mm o/dia to 47mm o/dia.
Threads are available in NPT and Metric.
Colours black or grey.
Adaptors come in straight, 45º or 90º with threads in plastic or metal.



If NPT threaded units are not readily available in your country, use metric fittings with male NPT-to-female metric adaptors which are readily available (from Liquip if you wish).

To achieve IP68 rating (waterproof) it is essential that seal caps be fitted to the conduit ends before clipping into threaded adaptor. The flat gasket is under the shoulder of the screw fitting. Thread sealant should be applied as additional surety against leaks and vibration.

Example:



CONDUIT ENTRY TO REAR OF ELECTRONIC BOX

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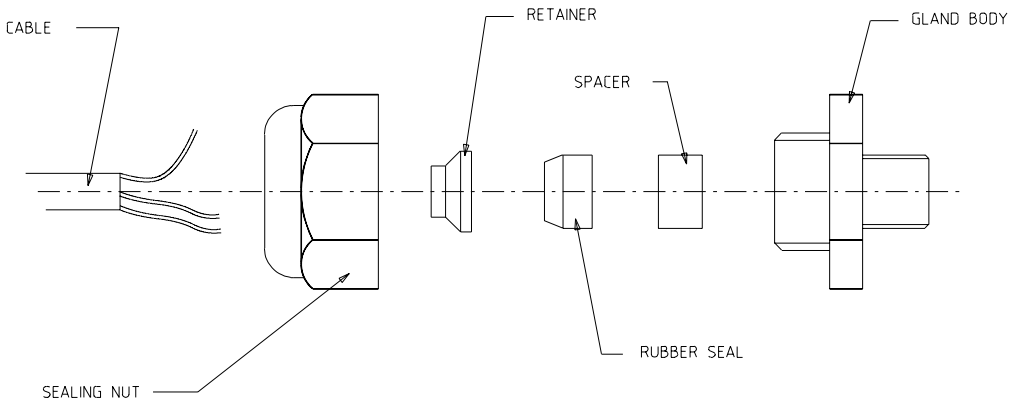
TYPICAL GLAND

Where outer-reinforced cabling is used (e.g. between EMH500 register and electronic junction box) it is permissible to dispense with the separate conduit.

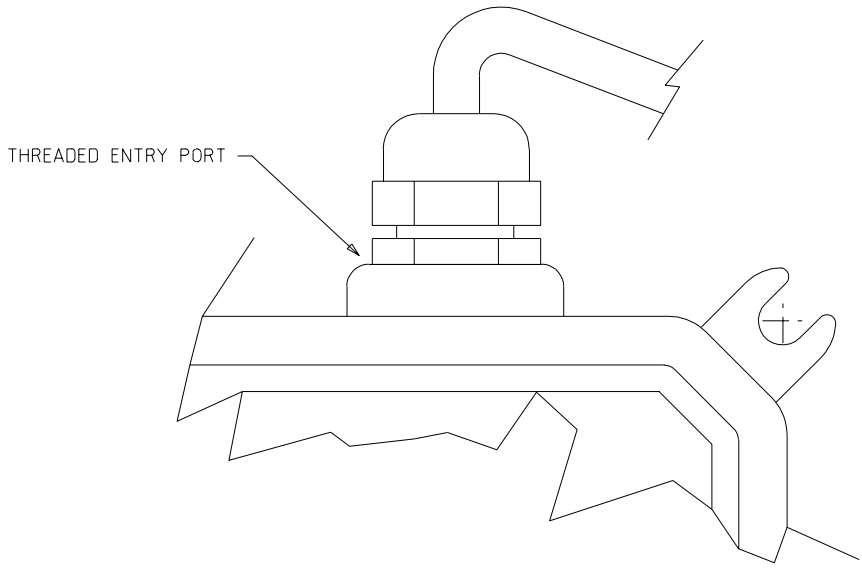
Instead, a gland is used. The front body screws into the NPT port in the housing and a sealing collar and gland screw down on to the cable to provide a liquid tight connection. Thread sealant should be applied as additional surety against leaks and vibration.

A pig-tail style is used if the cable run requires a bend.



For each size of NPT port, a wide range of gland seals is available so be sure to check the diameter of your cable and order accordingly.

Example:



SHOWN: GLAND IN EJB101

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PORTS WHICH ARE NOT USED

The push-in plastic plugs supplied with the housings are only for protection during storage and shipping to fill the ¾ inch NPT holes.

When installing on a vehicle, these plugs are removed and discarded and must be replaced with pressure-tight metal or plastic screwed plugs. Thread sealant and/or gaskets may be required with some types to achieve water-proofing.

PART NUMBERS AND SOURCES IN AUSTRALIA

In the typical 20mm (¾ inch) size:-

Conduit and Fittings, PMAFIX		Liquip Part Numbers
Conduit	PAST-17B/U	5822
Straight fitting	BF NO-M207T in 20mm metric thread	5821
or	BF NO-N20* in ¾ inch NPT thread	not stock
90º fitting	BPWO-M202T in 20mm metric thread	5817
or	BFWO-N20* in ¾ inch NPT thread	not stock
NFN3-16	Seal cap for end of conduit	comes with 5821 & 5817
SFN4-M20	Flat gasket for adaptor thread	comes with 5821 & 5817

Above from Treothan Trading, Brookvale NSW
Phone: (02) 9907 1788 Facsimile: (02) 9907 1778

Glands, Heyco

Straight plain	¾ inch NPT x 11mm to 18mm cable	6820
or	¾ inch NPT x 6mm to 12mm cable	not stock

(Equivalents are also available with pigtails)

Above from NPA, Kilkenny, South Australia
Phone: (088) 268 2733 Facsimile: (088) 268 1455

Junction Box

Junction box with 3 way threaded M20 conduit ports. Sealed to IP66	5104

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Adaptors, NPT to Metric	Liquip Part number
¾ inch male NPT x 20mm female metric. Blackwood part number 02183356.	5040
½ inch male NPT x 20mm female metric. Blackwood part number 01909956.	6778

Branches throughout Australia.

Liquip Part numbers:

5060	Gland M20 x 10 cable
5821	M20 x 20 conduit terminator straight
5817	M20 x 20 conduit terminator 90°
5822	Conduit, 20mm flexible
5815	M16 x 16 conduit terminator straight
5811	M16 x 16 conduit terminator 90°
5816	Conduit, 16mm flexible
5040	Adaptor M20 female to ¾" NPT male
6778	Adaptor M20 female to ½" NPT male
6775	Adaptor M16 female to ½" NPT male
6812	Adaptor M20 female to M16 conduit male
5436	Plug ¾" NPS

- May not be available ex-stock in NPT thread.
- Above metric threads are conduit type metric threads.

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WIRING WISDOM

Attention to detail during installation is essential for correct operation of the unit. The following points are emphasised in order to minimise any problems from "spikes" in the power supply or stray signals which may be picked up from equipment such as the alternator or starter motor.

* Take your power supply from the battery isolation switch, or a directly connected central point: not from an intermediate source. Ground must be totally common to all equipment and preferably off the battery/chassis connection.

* Run power supply in separate conduit to other equipment such as CB radio or solenoids. All signal wires are preferred to be run in separate conduit to power wires but this is recognised to be not always possible.

* Run power supply and signal conduits well clear of equipment such as the alternator and starter motor.

* Use only soldered joints or tool-crimped connections.

* Shielding is critical and these rules must be practiced:-

  - All signal wires must be shielded. Below 30 metres, one overall shield in multi-core cable is sufficient but above this distance every cable should be individually screened.

  - Small millivolt signals should be transmitted by shielded twisted pair wire.

  - Ground the shield at the EJB power box end only. Do not ground the shield at the other end i.e. probe, register, TPC etc. All connectors have their own ground terminal but all of these are common on the PCB.

* Vehicle Common Ground

  Always run grounding cable from battery ground to all components. Never rely on using the vehicle chassis as an electrically continuous common ground.

* Screw-clamp terminations should use ferrules over the wire-end or, as a poor second choice, bend the bared wire back over itself to provide more clamping bulk.

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RECOMMENDED CABLE TYPES FOR SYSTEM WIRING

Item	Usage	Cable Type	Comments
1	EMH500 to EJB	25-core 24AWG or 0.22mm^2 foil shielded with drain wire RS232 cable, 10.7mm N.O.D. Polyurethane sheath.	Supplied with EJB power box.
2	Power Supply	2-core shielded 18AWG or 1.5mm^2 Foil shielded with drain wire. (Red/Black).	Rated @ 24Vdc 5A or 12Vdc 5A.
3	RS232 Port 1 or 2	4-core 24AWG or 0.22mm^2 foil shielded with drain wire. COMM 1: Sheath Black COMM 2: Sheath Blue	Wire colours inside are blue, white, red and black.
4	Temperature Probe	N/A	Integral to probe.
5	Hi-Speed Pulser	5-core 24AWG or 0.22mm^2 minimum foil shielded cable with drain wire.	
6	Remote Reset	2-core cable 24AWG or 0.22mm^2 foil shielded.	Standard cable.
7	Pulse Output	2-core cable 24AWG or 0.22mm^2 foil shielded	Standard cable.
8	Solenoid (each)	2-core shielded 18AWG or 1.5mm^2 foil shielded with drain wire. (Red/Black).	Max 2 amp each @ 24Vdc.
9	Monitor to overfill probes	10 core overall screened, conductor size minimum 1.5mm^2 or 18AWG	Refer to system wiring diagrams
10	Monitor to truck plug	For TP104 2 wire system, use 10 core overall screened. For TP103 5 wire system, use 5 core overall screened. Both cases minimum conductor size of each core is 1.5mm^2 or 18AWG	

Appendix 1

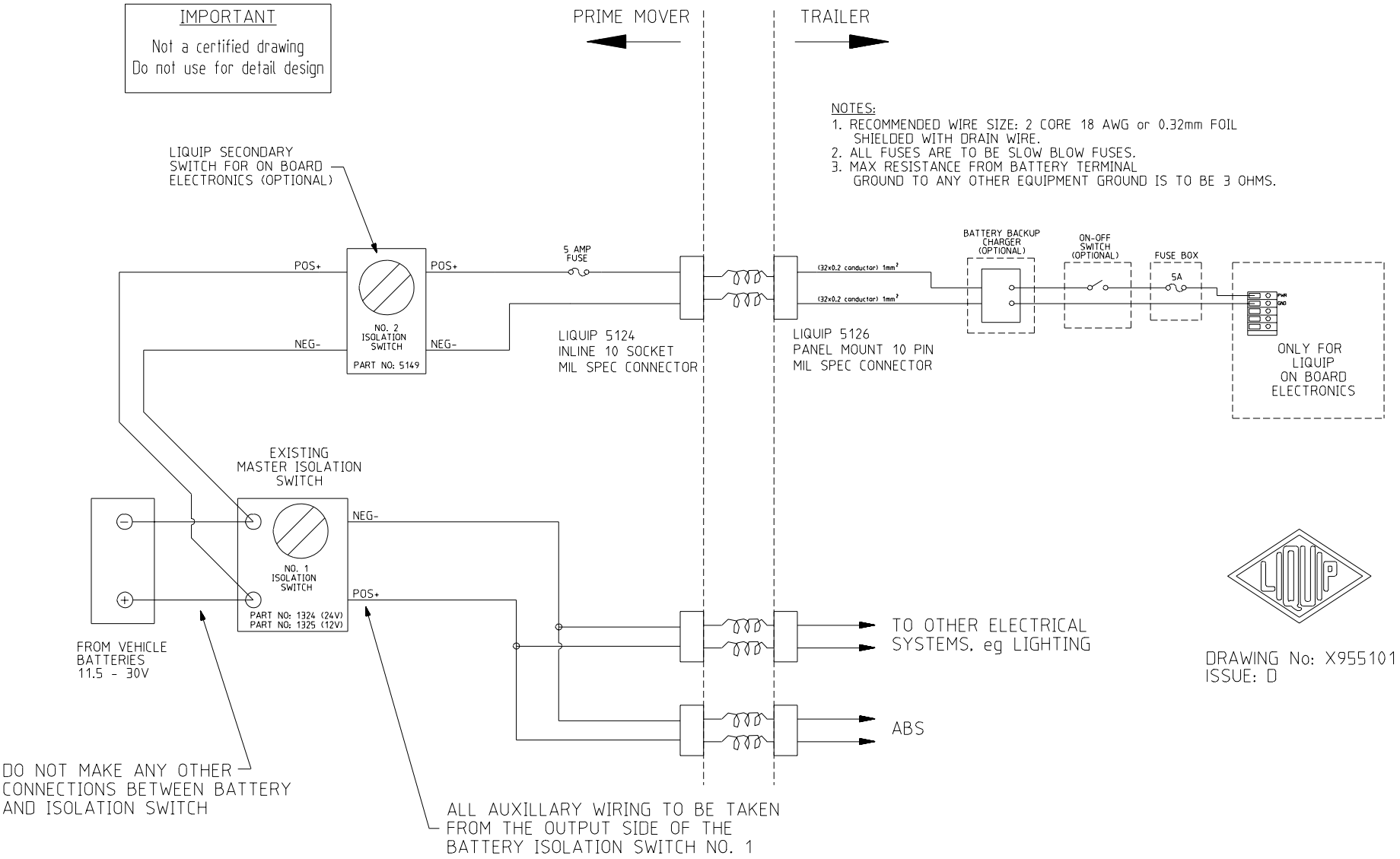
Tech Talk 46: Wiring for Liquip Road Tanker Electronics.

This tech talk should be read in conjunction with tech talk 37: Wiring wisdom.

General Guidelines for Liquip Electronics on Vehicles.

- Ensure tanker and vehicle are gas free.
- Ensure tanker and vehicle are in a non-hazardous area.
- Use anti-seize lubricant or water-proof grease on all screw-in equipment and fasteners.
- Never weld on a vehicle unless all electronic equipment is completely disconnected electrically from both the tanker and other equipment.
- Use high quality water-proof conduit and fittings to IP66 minimum for all wiring and junction boxes.
- Use water-proofing flexible compound such as silastic in all glands and joints not available as water-proof by design.
- Mount all equipment away from direct spray areas such as behind the tyres and out of direct sunlight. Always select the most sheltered aspect.
- Coat all terminals and cable end and joints with non-conducting grease or vasoline after final testing.
- Check entire electrical circuit and housings for potential water entry prior to sign off.
- Cable ends may be crimped with ferrules for better connection but do not just solder cable end (fatigues and corrodes). Or, as a poor second choice, bend the bared wire back over itself to provide more clamping bulk.
- Common grounding of a system is most important. Do not rely on common chassis grounding at various points, run a full-length dedicated ground cable. Max resistance, battery-ground to any ground-point, to be 1 ohms.
- Crimp joints are preferred to solder joints. Pre-coat with grease for corrosion protection.
- Always fit as much loose cable length into junction boxes and housings as practicable to allow for future servicing.
- When pulling multiple cables through conduit, always consider using cable with one or two extra conductors to allow for any future requirements.
- Always completely segregate power and intrinsically safe wires into completely separate conduit and in accordance with I.S. wiring rules.
- Carry out complete wiring check for accuracy and continuity before connecting power to any device.
- Observe international and local legal requirements. In the event of conflicting instructions seek qualified advice before proceeding.
- Apply cable relief inside all housing entries.
- All equipment to be supplied from a fused power supply.
- If no power, first check battery charge and fuses in supply line.
- Bags of desiccant are not effective - good water proofing is.
- Do not route communication cables past ‘noisy’ electrical apparatus such as solenoids and alternators.
- Check instruction manuals for recommended cable type.
- Use specialised, genuine tools for all electrical work.

RECOMMENDED WIRING WHEN VEHICLE MAIN ISOLATION SWITCH MAY BE 'OFF' DURING TRANSFER OPERATIONS.



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RECOMMENDED WIRING WHEN VEHICLE MAIN ISOLATION SWITCH IS ALWAYS 'ON' DURING TRANSFER OPERATIONS.