16 August 1999

TECH TALK 38

BOTTOM LOADING - VAPOUR RETURN FITTINGS ON GANTRY AND SERVICE STATION

Liquip have designed and manufactured mechanical and electronic equipment for gantries and tankers for bottom loading for over 20 years.

These notes list the options available in the various sub-sections of the system with, if applicable, any significant experiences we have come across.

Only subjects which are affected by industry standardisation are covered here.

Yours sincerely

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ENGINEERING MANAGER

1.0 LOADING, LIQUID LINE.

1.1 Truck API adaptor and gantry loading arms to be angled down at 15° or be straight?

ITEM	FEATURE	RESULT
15° Slope.	Better drainage from valve.	Few ccs difference only.
		More difficult to make pipes.
	Claimed ergonomic benefits.	
Straight.	More retained product in valve.	Few ccs difference only.
		Easier and cheaper to make pipe.

Liquip Comment:

Operationally there is no significant difference and it is a matter of personal preference.

Furthermore with bottom loading arms using drop hoses, there is often sufficient flexibility for easy loading of 'mixed' angles. However, each country should choose a standard then stick to it.

1.2 OVERFILL PROTECTION SYSTEM, 2 WIRE Vs. 5 WIRE.

2 Wire vs 5 Wire Overfill Protection System

FEATURE	RESULT
2 wire probe electronics is simpler	2 wire is cheaper to make
2 wire has less connections	2 wire is easier to maintain and install Requires less skills and less likely to suffer from mistakes
2 wire monitor has one channel per compartment 5 wire has only one channel with all probes linked in series	5 wire monitor is less complex because only one channel is used. Therefore cheaper to make
Each 2 wire channel is independent, in parallel 5 wire are all in series	2 wire is easier to diagnose 5 wire system cannot diagnose past the first fault
2 wire system requires a dummy if less than the maximum allowable numbers of compartments (eight) 5 wire does any number from one to 14	2 wire dummy is an extra cost compared with 5 wire 2 wire cannot be used if more than 8 compartments or tanks
2 wire systems are available from more suppliers than are 5 wire	More competition in 2 wire systems therefore possible cheaper, Spare parts more readily available
2 wire probes can be tested with simple effective methods 5 wire probes require expensive elaborative tester	2 wire cheaper to maintain

1.3 GANTRY PLUG & TRUCK RECEPTACLE NUMBER OF BAYONET SLOTS.

The current issue of API RP1004 was written in 1988. At that time the perceived system was to be a 2 slot bayonet for thermistors and 3-slot bayonet for optic probe systems. Since then, premature wear and contact problems with 2-slot systems have led to it being discarded and several years ago a 4-slot bayonet was introduced. However RP1004 has not yet been up-dated.

In 1995 the I.P. code of practice recommended the use of 4-slot 10 pin gantry plugs and truck receptacles for all systems be they 2-wire or 5-wire, thermistor, optic or capacitive.

ITEM	FEATURE	RESULT
3 Slot bayonet	Standardised in API1004 for optic probes only, 5 pins, 5 wire system.	Should not be used for thermistor or 2 wire systems.
2 Slot bayonet	OBSOLETE	OBSOLETE
4 Slot bayonet	I.P standard for all types for maximum interchangeability.	Will operate with thermistors or optics and 2 wire or 5 wire if gantry monitor suitable.

Liquip Comment:

It is suggested that adopting the "new" international 4-slot 10 pin format as in I.P code will allow full interchangeability between all systems or during any interim changeover period. (Gantry monitor permitting eg Liquip Probe Doctor will load all systems and all probes).

1.4 VAPOUR RECOVERY CONNECTORS - MALE ADAPTOR AND FEMALE COUPLER.

World-wide there are several variants on these and interchangeability has been and still is a problem. It is essential that the male and the female, for both the gantry and the service station, are considered as a pair and not as two separate items.

APIRP1004 specifies an open 4" camlock for the vapour adaptor.
A 'dry-break' poppeted adaptor is to be fitted only if demanded by local authorities. No specifications for such a poppeted adaptor are listed.

IP Code of practice calls up 4" camlock but illustrates a poppeted type.

Generally three main systems are in use:-

(i) Open male 4"camlock, open female 4" camlock.
(Not 'drybreak').
(ii) Poppeted male 4" adaptor, open female with probe which pushes open poppet in male.
(Part 'drybreak').
(iii) Poppeted male 4" adaptor with poppeted female 4" coupling which open each other when connected.
(Fully 'drybreak').

See table on the next page.

ITEM	FEATURE	RESULT
(i) Open male with open female camlocks.	Standard camlock form.	Can be confused with liquid hoses and connected wrongly.
	Open (no poppet).	If cap or hose not connected will blast vapour out.
	Open (no poppet).	Loss of all vapour in piping system when disconnected.
	Standard fitting.	Cheap - Good availability - World standard.
(ii) Poppeted male, open female with probe.	Standard camlock form.	Can be confused with liquid hoses and connected wrongly.
	Poppeted male.	Drybreak, retains vapour in pipework.
	Open female with probe.	Open, loses all vapour in hose.
		Can be connected to liquid adaptor.
		More expensive than plain open type.
		No standard to manufacture to.
(iii) Poppeted male and poppeted female.	Poppeted male has short nose section.	Prevents liquid hose being connected.
		Poppet retains vapour in pipework.
		More expensive.
		Manufactured to Australian AIP standard to ensure interchangeability. However, no World standard.
	Poppeted female.	Retains all vapour in hoses.
		More expensive.
		Manufactured to Australian AIP standard to ensure interchangeability. However, no World standard.

Liquip Comment:

In our opinion this is the least-standardised inter-company connection point of all.

The choice of (i), (ii) or (iii) is completely up to the local authorities and company representatives. If the choice is (i) or (iii), written standards exist for anyone to manufacture to. If (ii) is chosen it is recommended that a standard be drafted out to ensure compatibility between all brands of equipment.

1.5 VAPOUR RETURN HOSE.

1.5.1 Hose location.

This item is covered here for both loading and discharge as the two cannot be divided when considering pluses and minuses.

Possibilities are:-

(i) Hoses kept at gantries and receiving sites. No vapour hose on tanker.
(ii) Hose at gantry, separate hose carried on tanker for use at receiving site.
(iii) Hose carried on tanker - no hoses at gantry or receiving site.

ITEM	FEATURE	RESULT
(i) No hose on tanker.	Hose required at every receiving site.	Storage - security - maintenance - new sites - large quantities - cost . . . all are against this method.
	No hose on tanker.	More payload.
	Hose on gantry.	Difficult to provide interlock to terminal automation system for "hose connected".
(ii) Hose on gantry for loading, hose carried on tanker for discharging.	Hose carried on tanker.	Less payload.
		Cheaper than equipping every receiving site.
		Requires more room in hose tray.
		More wear and tear.
	Hose on gantry.	Difficult to provide interlock to TAS for 'hose connected'. More hoses required.
(iii) Hose on tanker only. None at gantry or service station.	Inboard end of hose is permanently attached to tanker vapour piping.	No interlock required on this inboard end of hose - no cost.
		No drybreak poppeted male adaptor required on inboard end of hose . . . cheaper - no maintenance - less weight.
	No hose at service station.	As above.
	No hose at gantry.	Cost saving, hardware and installation.
		Easy to link into TAS.

Liquip Comment:

It is generally agreed that (i) is impractical, so given that a hose must be carried on the tanker anyway, there is much logic and cost saving in favour of option (iii).

1.5.2 Vapour Hose Size and Adaptor Locations.

This covers both loading and discharge as the two cannot be separated.

API RP1004 calls up 4" camlock connectors.

It makes no recommendation for hose diameter but notes pressure drop should be minimised and cautions particularly against under-sizing when multiple-hose filling or discharging. World practice is to use 4" diameter hoses to match the 4" vapour couplers with 4" hose tails and allow multi-hose operation at low pressure-drop.

Adaptor locations are called up in API RP1004 as **either** by the API adaptors **or** at the rear bulkhead. Not necessarily **both.**

IP code specifies only the location adjacent to the API adaptors.

ITEM	FEATURE	RESULT
Fitting two vapour adaptors to tanker.	Two adaptors and caps to be bought.	Twice the cost.
	Two adaptors to be fitted.	Twice the cost.
	Branch off vapour pipe.	More cost.
	More weight.	Less payload.
	Maintenance.	Twice as much.
	Two choices of hose connection.	Easier to ensure any hose will reach.
Fit only one adaptor.	Fit one adaptor only to rear of API adaptors*. (*If vapour hose is permanently fitted to tanker, this permanent connection point is the same as the adaptor location.)	Less cost - weight - installation cost - maintenance cost.
		Complies with API RP1004 and IP code.
		Must ensure all hose sufficient length to reach.

Liquip Comment:

If the local oil industry agrees on spacing standards for loading arms, vapour recovery adaptors, truck adaptors, service station fill points and service station vapour adaptor points, then one adaptor on the tanker is quite adequate with the 4 metre vapour hose length which is proposed. It will cover both small rigid and large semi-trailer configurations.

It should be remembered that the USA was the “guinea-pig” for vapour recovery and in the early days there was a lack of understanding of the importance of industry standards. The reason for USA tankers appearing with features such as twin locations for vapour adaptors and three different types of overfill protection socket is because they are still struggling to overcome the early mistakes.

Other countries have been lucky enough to benefit from this experience and can standardise prior to implementation.

2.0 DISCHARGING.

Note:- Vapour recovery hoses, adaptors and couplings were covered in 'loading' above as they form a single issue.

2.1 Pressure Vacuum Vent Valve on Retail Sites Vapour Pipes.

ITEM	FEATURE	RESULT
Pressure vacuum vent to be fitted.	Supply and fit.	Cost of initial installation.
	Maintain.	Cost of maintenance.
		Safety implications in maintenance.
		Cost of administration.
	Benefit gained.	USA and Australian authorities - practically nil.
	If pressure poppet jams.	Tanker slow to unload.
		Extra stress on pipe and tank causes leaks.
	If vacuum poppet jams.	Vaporisation at pump inlet prevents flow. In hot climates this can happen if the vacuum is working correctly but it still applies a restriction.
Leave vent open as is.		Tests have shown pressure balance between u/g tank and tanker is over 95% effective in retaining vapour.

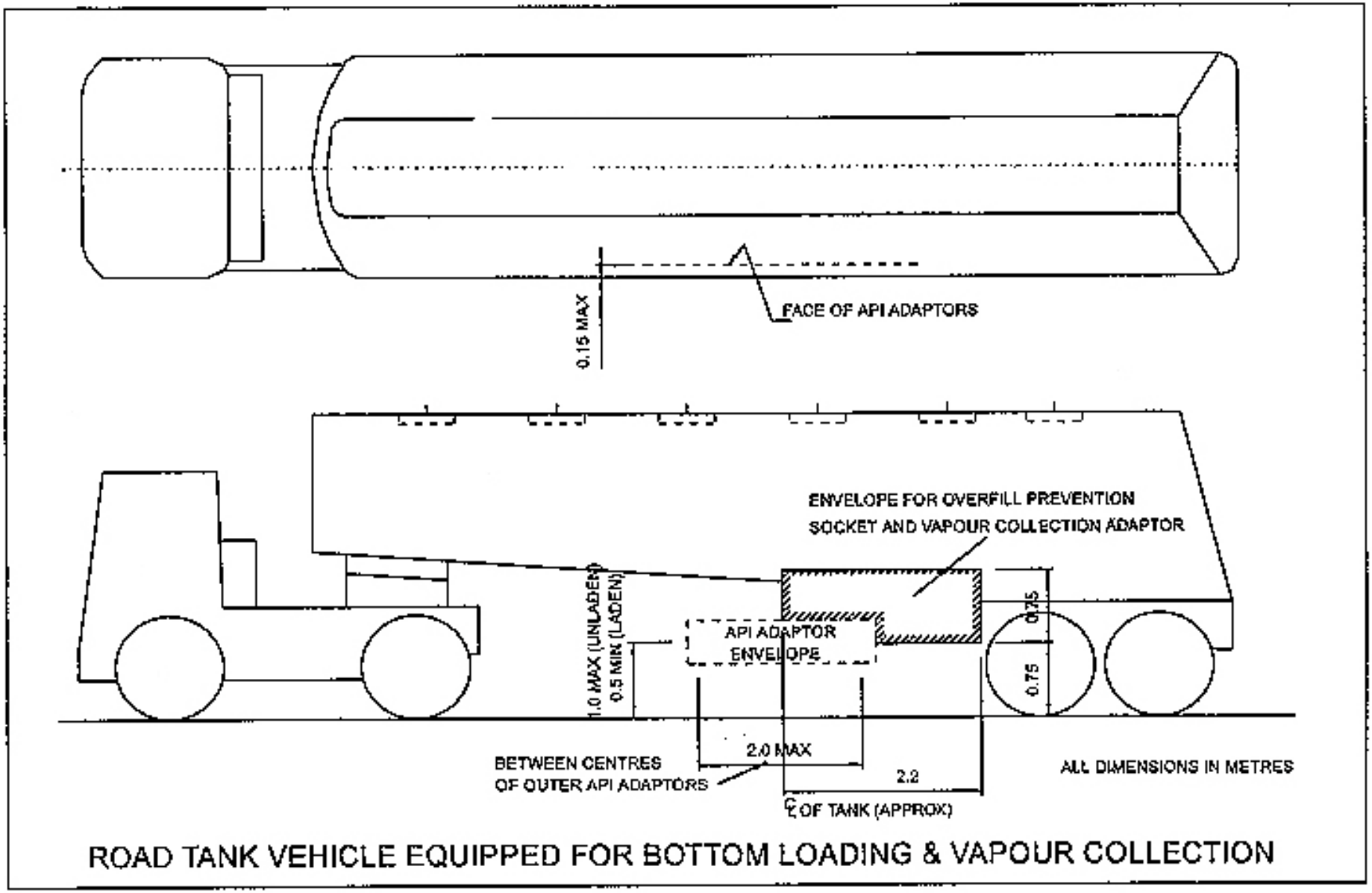
Liquip Comment:

On underground tanks pressure-vacuum vents are not environmentally beneficial and can be harmful.

2.2 Vapour Adaptor Location, Service Station.

General Note:-

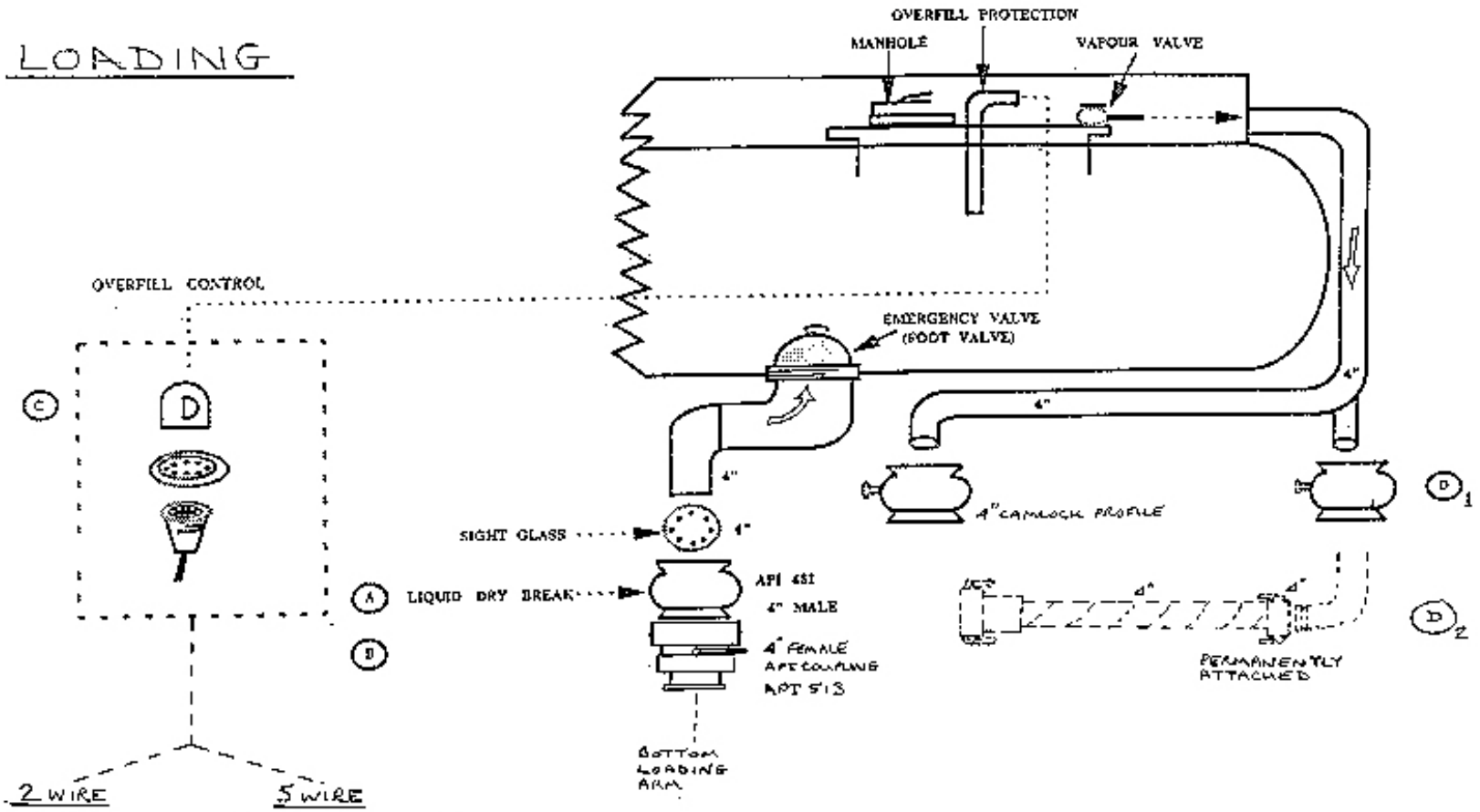
All service stations are now built or have been converted to provide all liquid fill points and vapour return points in one manifold area which is well away from dispensers. This ensures the vapour and liquid hoses can reach their adaptors and tankers can discharge quickly, in one position and without stopping service station operations.



ROAD TANK VEHICLE EQUIPPED FOR BOTTOM LOADING & VAPOUR COLLECTION

INDICATIVE ONLY

VAPOUR RECOVERY SYSTEM



2 WIRE

TP104 TRUCK PLUG
4 SLOTS

FCC100 CAP

DP 250 DUMMY

8 COMPT MAX

5 WIRE

TP103 TRUCK PLUG
3 SLOTS ?

FCC100 CAP

DP 250 DUMMY

8 COMPT MAX

GANTRY

GP104 GANTRY PLUG
4 SLOTS

PD 108-240 MONITOR

GP103 GANTRY PLUG
3 SLOTS ?

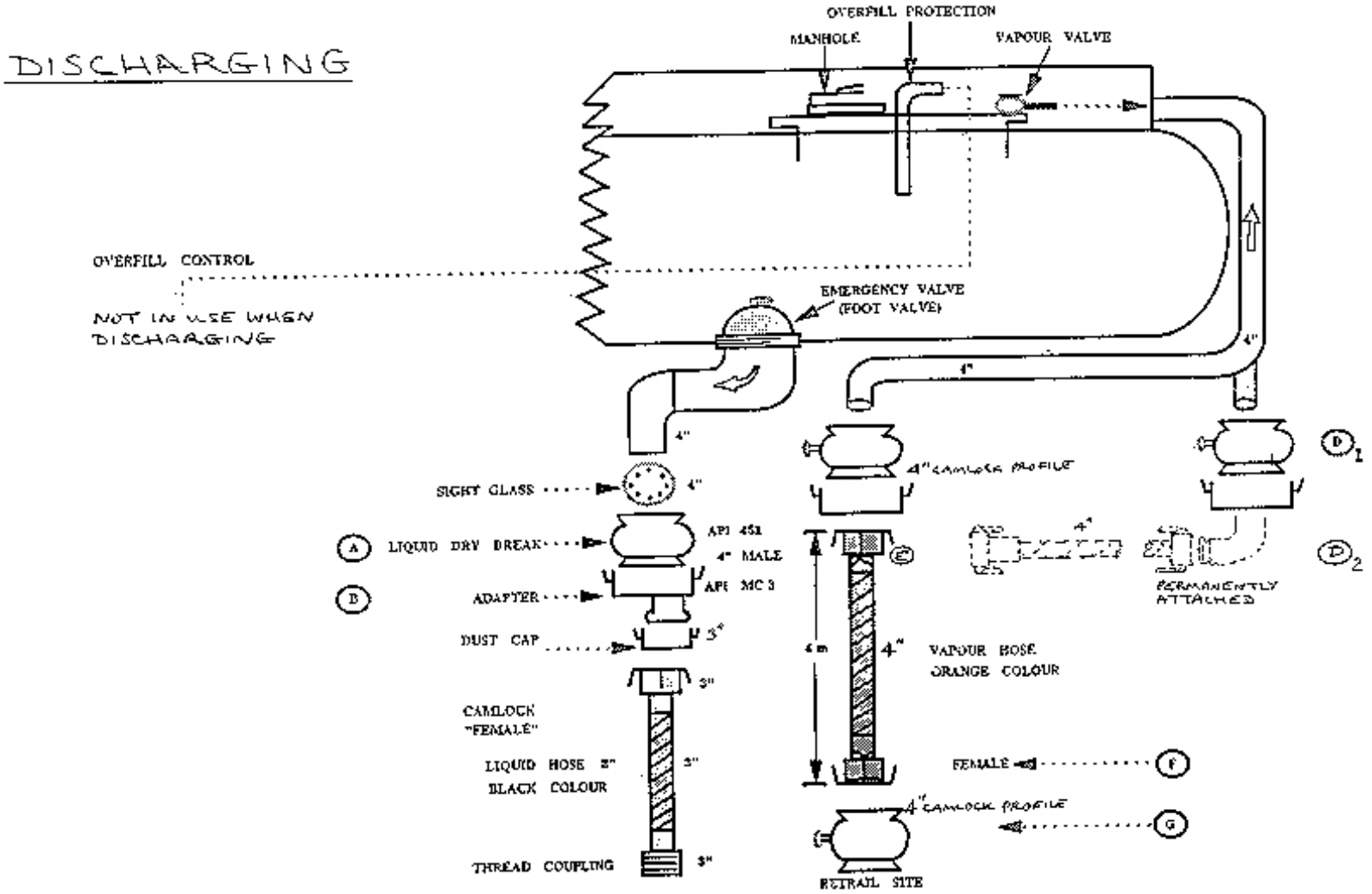
PD 108-240 MONITOR

LOADING

INDICATIVE ONLY

VAPOUR RECOVERY SYSTEM

DISCHARGING



INDICATIVE ONLY

DISCHARGING