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TECH TALK 0078
LIQUIP "LDP" OVERFILL PROTECTION PROBE
OPERATIONAL PARAMETERS
17/7/2007

Introduction

Requirement was to better define the operational limits for optical overfill probes with particular regard to the properties of the liquids being handled at their working temperatures, colour, particle inclusions, coating build-up, chemical composition and so on.

Scope of Investigation

The original scope was limited to investigating operation with Australian crude oils then expanded into operation with a wide range of petroleum products and other liquids.
Detailed results of petroleum products at low temperatures are attached to demonstrate the scale of the work.

Summary of Operational Parameters

- Temperature -40°C to +100°C. (Note Haz. Area Approval is -40°C to +65°C for safety).
- Pressure to 600 kPa internal tank pressure, -3 kPa internal tank vacuum.
- Liquid must have refractive index from 1.10 to 1.47. (If in doubt, carry out test on sample of liquid).
- Liquid must not be reflective (e.g. milk will not trip the system into a "wet" signal).
- Liquid must be below 3,500 cSt viscosity at working temp. (Syrupy). However it must not gel at working temp. Build-up of coating on the prism to be 1mm maximum.
- Liquid must not contain particles which can form a clinging opaque surface coating on the prism. (E.g. paint).
- Use with standard petroleum products and water-based compounds only. Any other chemical content must be checked with Liquip before use.
- Do not install a functioning probe, or carry out routine tests, adjacent to any reflective, including white, surface. (Reflections can cause false readings).
- Do not allow sunlight to access the prism during operation. (Incident light can cause false readings).
- Install at sufficient depth in tank to allow ullage space for liquid "overshoot" flow while system is closing down.



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Special Considerations for Australian Crude Oils

- All crudes discovered in Australia to date are "heavy" types. (Bass Strait, West Australia, Moomba).
- ALL GEL AT NORMAL AMBIENT TEMPERATURES. (Solid at less than 30°C). Also they can contain varying amounts of particles in suspension.
- No optical probe can work with these crudes without cleaning the prism between loads.
- Options are:
 - i) Machine off the protective shroud to allow access to the prism so that an operator can reach inside the manhole and physically wipe the glass.
 - ii) Mount the probe in a Quick Release device such as a camlock cap so that it can be readily unclipped and washed in diesel or kerosene between loads.



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Tests Carried Out on LDP 102 11-7-07

PURPOSE To define the limitations of viscosity of liquids in the tank when using the LDP102 with respect to clingage and staying "wet".

EQUIPMENT Sample production LDP 102
OptoCap hand held tester
Electronic thermometer to +/- 2°C
Fridge
Freezer
Samples of each of the following liquids with their manufacturers data sheets:

Hydraulic Oil Castrol Hyspin AWS 68	ISO viscosity grade 68. (ISO grade number = kinematic viscosity at 40°C in CentiStokes, or mm sq/ sec)
Hydraulic Oil Shell Tellus 46	ISO viscosity grade 46
Engine Oil Shell Rimula SAE 30	ISO viscosity grade 90
Gearbox Oil Shell Spirax 80W-90	ISO grade 150

TEST PROCEDURE

Probe at ambient unless stated. 12°C.
Probe washed in Meths and dried between products.
Probe dipped slowly in and out of product samples ten times while observing wet/dry lights.
Probe held vertically and immersed minimum of 50mm each dip.

PRODUCTS AT + 4 DEGREES °C

Castrol AWS 68 - Visc at 4°C is 500 cSt.	Worked perfectly and instantaneously reverted to dry when lifted out of liquid.
Shell Tellus 46 - Visc at 4°C is 400 cSt.	Worked perfectly and instantaneously reverted to dry when lifted out of liquid.
Shell Rimula SAE 30 - Visc at 4°C is 1,000 cSt.	Worked perfectly and instantaneously reverted to dry when lifted out of liquid.
Shell Spirax 80W-90 - Visc at 4°C is approx 2,000 cSt.	Worked perfectly and instantaneously reverted to dry when lifted out of liquid.

PRODUCTS AT MINUS 15°C

Castrol AWS 68 - Viscosity at -15°C is approx only but above 3,500 cSt. Liquid is syrup-like but worked perfectly and dried within 1 second.

Shell Tellus 46 - Viscosity at -15°C is 3,500 cSt from Shell graph. Liquid is syrup-like but worked perfectly and dried within 1 second.

Shell Rimula SAE 30 - Viscosity at -15°C is not measurable, pour point is at -18°C. Liquid is syrup-like but worked perfectly and dried within 1 second.

Shell Spirax 80W-90 - Viscosity at -15°C is not measurable, pour point is at -15°C. Liquid is syrup-like but worked perfectly and dried within 1- 2 seconds.

NOTE: Products in this condition are not in any condition to be transferred, either by pump or gravity. They are too thick.



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SPECIAL TESTS

1. In order to induce a "failure-to-dry" some graphite powder was mixed in to a sample of the Shell Tellus 46. The intent was to create a reflective layer on the prism at withdrawal. Several increases in concentration were added with some slight delay in drying but not a failure. Then a mixture of dust and aluminium filings were added with yet another increase in time-to dry but still no complete failure (i.e. staying wet). At this stage the liquid resembled a slurry. Test ceased.
2. MILK. Test with milk confirmed the probe would not switch to "wet" when immersed.
3. GREASE. Coating with grease resulted in a normal "wet" reading when immersed. On removal, if the film was less than 1mm, it reverted to "dry". If the film was 1mm approx or thicker, it remained "wet". Proves that thin, clean and clear films are not a problem.
4. PROBE AND PRODUCT BOTH AT MINUS 15°C. This test was conducted to determine if the electronics speed was affected by probe temperature and also to see if clingage would be affected by the surface temp of the prism.

Results showed a slight slowing in drying time on removal but only to the extent of 1 to 2 seconds extra.

David Gregory
11/7/2007