COLLECTION AND SAFE TRANSPORTATION OF HYDROCARBON SAMPLES

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SUMMARY

This paper discusses the various types of collection methods and collection devices as well as the importance of proper collection cylinder construction, benefits of constant pressure sampling, together with comparisons of results from various sampling methods

Transporting samples for analysis remote from the collection point is often necessary and presents problems in selecting the appropriate container and mode of transport. Safe transportation is critical and subject to regulation, as well the integrity of the sample needs to be maintained. The various regulations and transport options

1. INTRODUCTION

The collection of hydrocarbon samples is necessary to provide the owners, sellers and buers of the product with a portion of that product that after analysis, can be used as a basis for determining cost or component make-up. With the advent of improved auditing and Quality Control procedures, the importance of providing accurate data is becoming increasingly vital, as consequence there are obviously important financial and processing implications dependent on accurate analysis.

It has been observed that the usual order of importance placed on the steps involved with determining the sample composition often is as follows:-

1. Accuarate analysis. A large amount of money be spent on analytical instruments that will give the user, compositions and BTU values to the best limits science can provide.

2. Extraction of a representative sample from the line. Only when it is discovered that spot samples taken from the wall of the pipe have severe shortcomings will some organisations see the value of taking their samples a little more carefully. Regrettably for some, this has sometimes been as a result of a dispute between customer and supplier.

3. Maintaining the sample between the collection point and the point of analysis. The best sampler and the best analyser will be of little value if the sample is not presented at the point of analysis in the same condition as it was initially extracted from the line. Somewhat analogous of having a poor amplifier between a CD player and quality speakers.

We will be discussing the latter point in this paper.

2. COLLECTION METHODS

The various collection methods for hydrocarbons are detailed in published codes and standards. Most of these emanate from the USA. Some of them are listed here. It should be borne in mind that many of the procedures described in these codes obviously do not presume that the operator has available all the equipment that may have come onto the market since the publication of the code. They will assume that the operator has a basic standard sample ll assume that the operator has a cylinder commonly known as a 'sample bomb' this is of the type illustrated in Figure 1. Typically it has openings at each end or sometimes at one end. It has to purged or filled with an inert fluid or gas before the sample
can be taken, it is primarily suitable for spot sampling only. If composite sampling is desired, one has the problem with this type of cylinder of completely displacing the volume in the cylinder, whilst at the same time retaining all the sample that has been extracted from the process line. If any of the sample is displaced (this will usually be that taken first) a representative sample will not be assured.

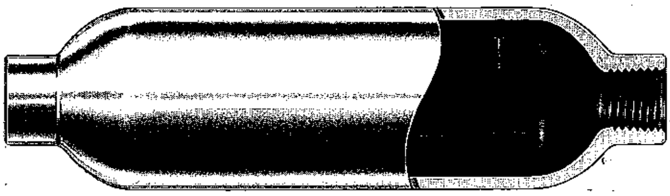

Figure 1. Standard Sample Cylinder

There are methods using sample bombs, whereby a representative sample can be taken, this however often involves complication in operation and a somewhat cumbersome equipment set-up. Whilst these systems may be satisfactory it often takes some special skill on the part of the operator, proper operation cannot always be guaranteed. Plus for some desired sample methods the 'bombs' are entirely unsuitable.

3. SAMPLING CRITERIA.

The sample has to be representative. i.e. faithfully reflect the composition of the product in all of its phases. When unloading a liquid tanker the product will range from light to heavy ends, through to water. If a spot samples are taken they will show only the composition of the product flowing in the line at the points in time at which the sample was taken.

Therefore samples should be taken frequently at the same rate and sample volume during the flow/loading cycle.

Unless there is an online analyser, the sample has to be taken and stored under the same conditions as those found in the process container or pipeline. For instance, if we have a light hydrocarbon at an elevated pressure, reducing the pressure will change the nature of some of the lighter components of the product.

From the above, some basic rules can be made for sampling, where the product has to be collected.

a) Spot samples should be taken only when the product is completely homogeneous.

b) Samples of lighter hydrocarbons and gasses should be taken, stored and introduced to the analytical device in the same condition as that existing in the process line or vessel.

c) Devices used for collecting the sample should be able to store only the sample with no other gas or liquid used to assist the collection becoming part of the sample. The gas or liquid used as an inert seal should be just that and not contaminate or absorb any of the sample components.

Likewise the materials of construction of the sample cylinder should not affect the sample. It is preferable that ASTM Grade 316 Stainless Steel should be used throughout for all wetted components. Even this has limitations, when used with gases having a H_2S component it has been found that it is possible for the H_2S to be absorbed into the stainless steel. Patented coating can be applied to the cylinder internals to prevent this problem from occuring.

d) In a flowing line where there is a possibility of variations in product composition, or the presence of impurities, samples have to be taken in the flow stream, after the product has been thoroughly mixed.

In addition, if the product composition is likely to vary during a period (i.e. wellhead flows or tanker unloading), composite sampling should be the method used, not spot sampling.

4. SAMPLING STANDARDS

API Chapter 8.1: ASTM D4057.81 & 88: Manual Sampling of Petroleum and Petroleum Products

API Chapter 8.2: ASTM D4177-82: Automatic Sampling of Petroleum and Petroleum Products
ISO 3170: Petroleum Liquids - Manual Sampling

ISO 3171: Petroleum Products Light Hydrocarbons - Automatic Pipeline Sampling

IP 206: Petroleum Measurement Manual

ASTM D 3700: Containing Fluid Samples Using a Floating Piston Cylinder

GPA 2166: Methods for obtaining Natural Gas Samples for Analysis by Gas Chromatography

GPA 2174: Methods for obtaining Liquid Hydrocarbon Samples using a Floating Piston Cylinder

5 COLLECTION METHODS - GAS SAMPLING.

We can now look at the various collection methods where sample cylinders are used. They are briefly described below, a more detailed explanation of these methods is contained in appendix A.

5.1 GPA Fill and Empty Method.

This method utilises two standard sample cylinders in series. The cylinders are then purged a number of times. The number of purges are dependent on the line pressure. After completion of the purging of the sample cylinder, the last cylinder is removed.

5..2 GPA Continuous Purge Method

The equipment used in this method is the same as in the Fill and Empty method, it is similar, except that this sampling method uses a continuous purge rather than a series of separate purges.

5.3 GPA Method for taking a Spot Sample in an Evacuated Cylinder or Standard Cylinder filled with an Inert Gas.

This method uses an intermediate purge for the system with the sample cylinder isolated and filled with an inert gas, using it as the last component in a dead-end system. This method has the advantage of not needing the same amount of purging that the previous methods required.

5.4 Drawing a Spot Sample into a Constant Pressure (Sliding Piston) Sample Cylinder.

The inlet piping is purged using the same criteria as in the fill and empty method. after the inlet piping has been properly purged the gas is then allowed to simply enter the fill end of the cylinder.

This method has distinct advantages, having only one sample cylinder and only the inlet piping needing to be purged. This type of cylinder is illustrated in Figure 2.

Details of the above methods are contained in appendix A.

The above methods above vary in complexity depending on the manifolding set-up; the Constant Pressure Sample Cylinder method being the most simple. The complexity of operating the various methods depends mainly on the amount of purging required, again the Constant Pressure Sample Cylinder has the least amount of dead space to evacuate.

Note; the above methods are related to spot sampling. Continuous sampling is possible using these methods, after the appropriate purging procedures have taken place.

It is obvious that the most reliable method would be one using the Constant Pressure Sample Cylinder. This procedure has the following advantages:-

a) The set-up is simpler.

b) The collection method is easier.

c) Sample collection is quicker.

d) There is a minimal amount of purging needed.

e) There is no encouragement of liquid formation.

f) This type of cylinder can be used with wet gas.

g) Contamination of the sample is eliminated as there is no inert gas or liquid (which will also cool the gas) in contact with the sample.

h) If a continuous sample is required, this type of cylinder is more readily adaptable. There is no additional equipment or procedure needed.

i) Training of the personnel taking the sample is minimal.

j) The sample can be injected at line pressure into the analysing device rather than being bled into it at a reduced pressure. Thus light ends do not escape first and the heavier ends last, giving varying BTU readings throughout the analysis.

6. COLLECTION METHODS - LIGHT HYDROCARBON SAMPLING

Initialy, light hydrocarbon liquids were collected using the liquid displacement method, then with the introduction of floating piston types this method became the only acceptable method (GPA-2174). Because of the wide use of the standard cylinders, there has recently been qualified and renewed acceptance of liquid displacement

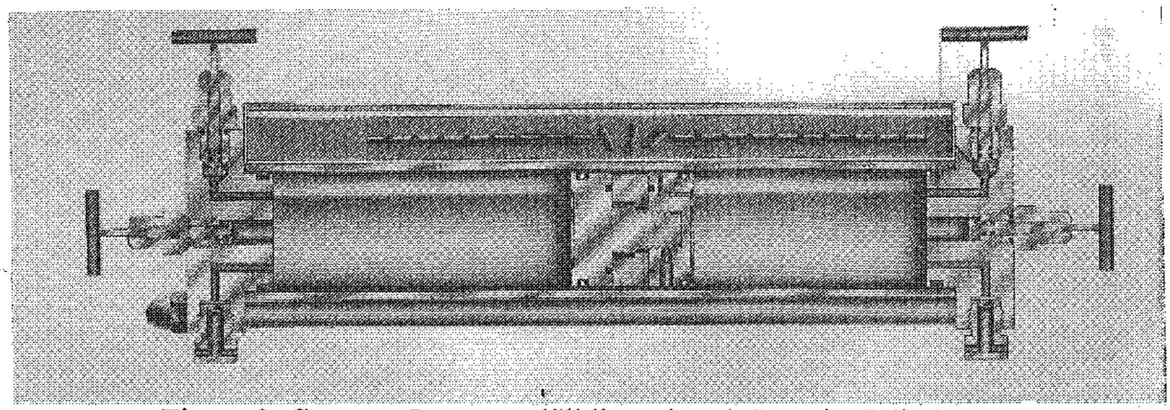

Figure 2. Constant Pressure (Sliding Piston) Sample Cylinder with Piston Position Indicator

methods. They are as follows

1. water displacement method (total removal - 80% hydrocarbons/20% displaced outage)

2. Water displacement (partial removal - 70% hydrocarbons /30% displaced outage 10% water remaining in the cylinder)

3. Ethylene glycol displacement (total removal - 80% hydrocarbons/20% displaced outage

The liquid displacement method whether using water or ethylene glycol (which is used when freezing is a consideration) should not be used if there is any possibility of the sample being contaminated or components of the sample being absorbed by the displacement liquid.

The method of taking samples using the liquid displacement method is described in appendix B. It should be noted that there are limitations and constraints that require an experienced operator to properly obtain a sample using this method.

After having collected the sample it is important that it is properly mixed before analysis. To achieve this with a standard cylinder is at best difficult. It can be achieved using a floating piston cylinder with bolted ends. Mixing is possible with the use of a ball type mixer or a paddle type (sometimes called a vortex) mixer with the cylinder having an extended indicator rod. These types are illustrated in figure 3.

Using the Constant Pressure or Sliding Piston sample cylinder will give the easiest, most reliable and simplest method of obtaining a sample.

7. COMPARISON OF SAMPLING METHODS

This said, we should not be distracted from the main purpose of taking a sample in the first place, that of obtaining the most accurate possible analysis. Let us now look at some results.

7.1 Chromatograph - Constant Pressure Cylinder (CPC) Comparison

(Taken over 6 successive months)

Month 1	Chromatograph	CPC
B.T.U.	1018.7	1019.2
GRAVITY	0.617	0.616
CO_2	0.57	0.55
N_2	3.32	3.24
C_1	89.44	89.62
Month 2		
B.T.U.	1026	1026.6
GRAVITY	0.6212	0.6217
CO_2	0.66	0.65
N_2	3.15	3.12
C_1	89.03	89.05
Month 3		
B.T.U.	1028.3	1029.1
GRAVITY	0.6212	0.6247
CO_2	0.69	0.65
N_2	3.02	3.15
C_1	88.71	88.89
Month 4		
B.T.U.	1019	1022.3
GRAVITY	0.6163	0.627
CO_2	0.64	0.71
N_2	3.03	3.7
C_1	89.89	89.59
Month 5		
B.T.U.	1019.6	1022.1
GRAVITY	0.6171	0.6197
CO_2	0.64	0.66
N_2	3.15	3.18
C_1	89.66	89.49

Month 6

B.T.U	1012.1	1008.6
GRAVITY	0.617	0.620
CO_2	0.61	0.61
N_2	3.67	4.09
C_1	89.35	88.86

The above readings were taken where a laboratory analysis was performed on a continuous sample taken with a CPC and compared with an on-line analyser reading. It clearly shows good correlation and when an average BTU reading is taken there is less than 1 BTU difference.

7.2 Spot Sample taken in a Standard Cylinder (SSC) vs Continuous Sample in a Standard Cylinder (Cont SC) vs a Continuous Sample taken in a CPC (Cont CPC).

(Readings taken over a 12 month period.)

Cylinder Type	B.T.U.	Difference
SSC	1154.3	11.8
Cont SC	1153.2	10.7
Cont CPC	1142.5	-
SSC	1160.9	19.5
Cont SC	1150.9	8.9
Cont CPC	1141.4	-
SSC	1144.6	17.8
Cont SC	1141.4	14.8
Cont CPC	1126.8	-
SSC	1105.0	13.2
Cont CPC	1091.8	-
SCC	1115.2	21.2
Cont SC	1108.2	14.2
Cont CPC	1094.0	-
SCC	1123.5	10.2
Cont SC	1118.2	4.9
Cont CPC	1113.3	-
SCC	1157.3	40.6
Cont SC	1124.1	7.4
Cont CPC	1116.7	-
SCC	1146.0	23.8
Cont SC	1127.8	5.6
Cont CPC	1122.2	-
SCC	1100.4	(17.8)
Cont SC	1108.5	(9.7)
Cont CPC	1118.2	-
SCC	1121.0	33.3
Cont SC	1111.2	23.5
Cont CPC	1087.7	-

These sample readings were analysed in a laboratory and then compared with an on-line chromatograph.

As can be seen, there are considerable discrepancies in the results using the samples taken with standard cylinders. The limitations of taking spot sample results are obvious.

7.3 Comparison of Spot Samples (taken over a month)

Day	B.T.U.	GRAVITY
1	1140.0	0.670
2	1139.7	0.670
3	1153.8	0.680
6	1129.3	0.665
7	1152.9	0.680
8	1147.8	0.675
10	1131.6	0.665
13	1114.4	0.654
14	1154.8	0.682
17	1116.8	0.655
20	1133.9	0.666
21	1106.5	0.648
23	1171.1	0.690

This clearly shows that if a spot sample is taken once a month, allowance should be made for a considerable margin of error.

From the foregoing it can be seen that the best results will be obtained by taking Continuous Samples using a Constant Pressure Cylinder.

8. COST OF SAMPLING ERRORS

Now let us look at what this could be costing us:-

Using as a basis a one BTU/kJ error. (For the purposes of this illustration 1 BTU is about equal to 1 kJ)

One Industrial Customer in Victoria using 3,000 GJ/day paying $4.13/GJ

kJ from monthly spot sample = 1020 kJ
kJ from composite continuous sampling = 1019 kJ: one kJ variation

Purchase price $4.13/GJ

3,000(1.020)($4.13) = $12,637.80 per day
3,000(1.019)($4.13) = $12,625.41 per day
Difference = $ 12.39 per day
for a 25 day month = $ 3,717.00 per year

Other customers could be using seven times as much gas. Conservatively they could be advantaged, or disadvantaged, to the tune of some $25,000 for each 1 kJ measurement error. As some of the samples in the examples above were as much as 40 times this amount, it would seem judicious that the sampling methods should be closely looked at by both the user and supplier.

9. TRANSPORTATION OF SAMPLES.

After a sample is taken into a sample cylinder it has to be transported to a laboratory for analysis. Usually this does not present a problem, as often the laboratory is within the facility where the sample was taken. However, there are occasions where the sample has to be transported to other locations necessitating the use of road, sea or air transport. The local regulations for the transportation of samples by land are usually straightforward as the sample is usually transported within an region supervised by a single authority. Problems arise when a sample is required to be shipped by air where there is no local authority with a specific ruling or approval procedure for air transportation. Plus, inevitably, the carriage will be between regions or countries that will not always have the same regulations or have differing interpretation of an accepted regulation.

Those involved with taking, analysing and storing samples are not to be expected to be familiar with the intricacies of the regulations involved with the transport of full cylinders. It is vital though to be aware that there are quite strict, and necessary, regulations governing the transport of products such as hydrocarbons, which are classified as 'Dangerous Goods'.

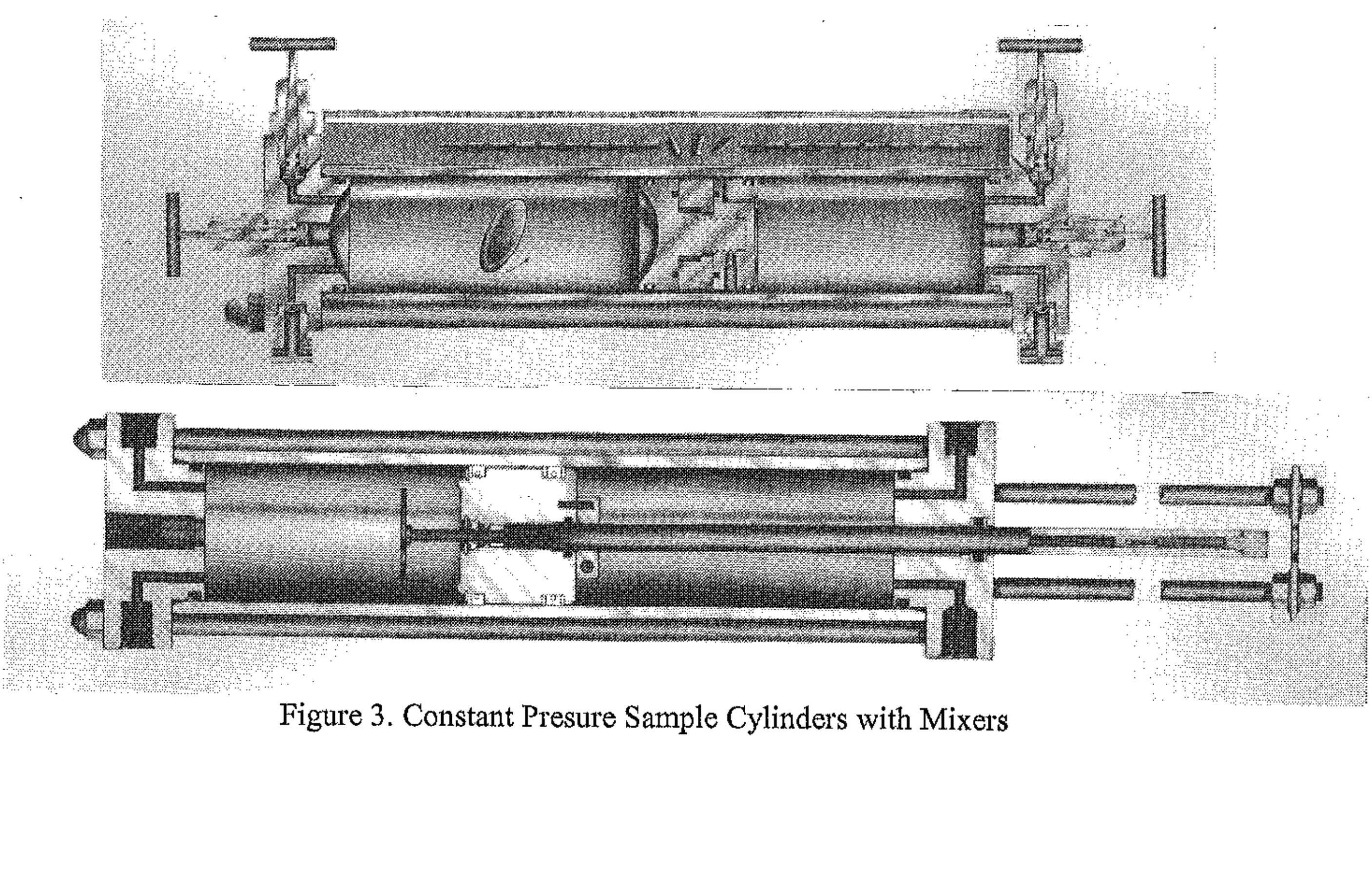

Figure 3. Constant Presure Sample Cylinders with Mixers

It is important to remember if transportation by air is required, that the proper procedure must be followed, otherwise the sample may arrive at the airport and sit there, because an airline will refuse to carry it.

9.1 Applicable Regulations

In the USA, the Department of Transportation will give exemptions to their Hazardous Materials Regulations (DOT-E3) of the Code of Federal Regulations Section 49 (CFR-49) which allows samples of hydrocarbons to be transported by land, sea or air, within specified constraints and with the sample contained in an approved container and packing. These regulations are quite specific and individual sample collection-/containment devices will be individually covered by such exemptions.

Within the U.S.A. the DOT exemption certificate will allow the relatively easy transportation of hydrocarbon samples. In the past the DOT certification has usually been recognised outside the USA, now this is not always the case. This is something that is often overlooked, especially by companies that have been used to using DOT certified products.

Within Australia as elsewhere, international standards are being adopted. Section 23 of the Civil Aviation Act specifies that the Council of the International Civil Aviation Authority (ICAO) - 'Technical Instructions for the Safe Transport of Dangerous Goods by Air' is the legal document which specifies what goods are classed as 'Dangerous Goods'. Hydrocarbons would be classified as Class 2 or 3 depending on whether they are Gases or Liquids.

Inevitably, if the sample is being transported in a pressurised sample cylinder it would at least in part, in its free state, be gaseous. Therefore it can be safely categorised as a class 2 material.

Practical direction is given in the other relevant document: the International Air Transport Authority (IATA) -'Dangerous Goods Regulations'.

The product will have to be identified by a UN number; a number assigned to products according to their degree of flammability or toxicity. Classification of the various types of dangerous goods are contained in section 3 of the document entitled 'Classification'.

It will have to be demonstrated that the cylinders are safe for containment of the product. This will involve, for compressed products, design in accordance with a recognised pressure vessel code. This code has to be recognised by the airline officials transporting the product; the person making the decision will not necessarily be familiar with overseas certification. It is better to use a code that can be readily identified. In Australia it is safer that Australian Standards are quoted, certification from a State Authority is even better.

The cylinder then has to be packed in a case that is 'suitable for the product'. Details regarding the suitability are contained in section 5. of the IATA document 'General Packing Requirements'. It is better to carry the cylinders in a case that has been especially constructed to protect the valving, gauges and any other vulnerable protrusions during transport.

Prior to transport there is a standard form to be filled out, a copy of such a form is contained in Appendix C. Though the form is a straightforward document it should be filled out by personnel familiar with the requirements of the IATA regulations. An error causing the goods to be misclassified will result in problems. Once a problem has occurred it is often difficult to correct.

The simple solution is to seek out a properly qualified freight forwarder specialising in Dangerous Goods. They will advise on proper descriptions, identification, packing, marking, permissible volume, type of aircraft, forms and permits for transport to regions that may require additional bits of paper to accompany the goods. All codes and regulations must be observed, in addition all paperwork properly completed. A possible consequence that has been known, is for cargo due to be offloaded part way through to the final destination for transfer to another aircraft, to be denied the facility.

10. CONCLUSIONS

The final collection process of sampling is at least as important as the other components in the sampling and analysing cycle. The various methods used will give varying results. It has been found by extensive testing and comparison that the constant pressure sample cylinder is the most effective and easiest method of collecting a sample.

Relatively small errors in BTU/kJ figures can cost users or suppliers a considerable amount of money. Management audits should dictate that attention is paid to this aspect of an organisations costs.

Transporting samples especially by air can cause considerable trouble if a basic understanding of the transportation authorities requirements are not noted. As well as the DOT requirements in the USA that have in the past been accepted in many other parts of the world, there are now international standards being adopted. All potential users should be aware of these requirements and seek the services of those competent in the transport of dangerous goods before committing themselves to the transport of hydrocarbons.

11. ACKNOWLEDGEMENTS

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John Renfrow of Transok, Tulsa, Oklahoma for data collection and comparison of results.

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12. REFERENCES

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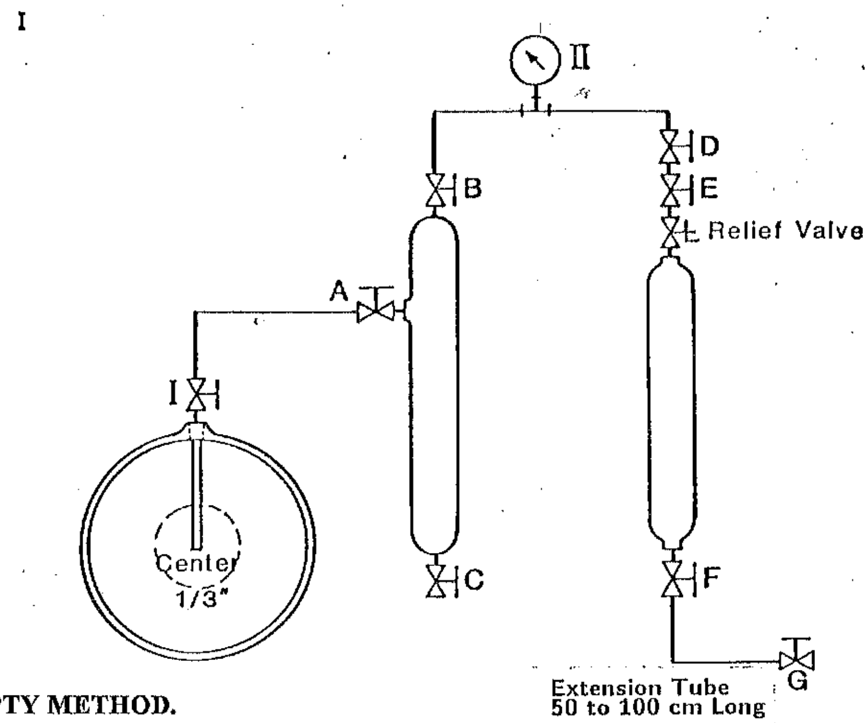
Appendix A



1. GPA FILL AND EMPTY METHOD.

I. Sample Probe
II. Sample Pressure Gauge

Procedure:

1. Open valve I to purge any accumulated foreign matter in probe or valve.

2. Conect manifold to probe valve I. Close valve I.

3. Open valves A,B,D,E,F. Close valves C and G.

4. Open valve I to allow full pipeline pressure to fill the manifold completely.

5. Close vale A and open valve G.

6. Close valve G and open valve A to fill system to line pressure.
(Steps 4 through 6 need to be repeated 3 to 5 times until all air has been eliminated from the system)

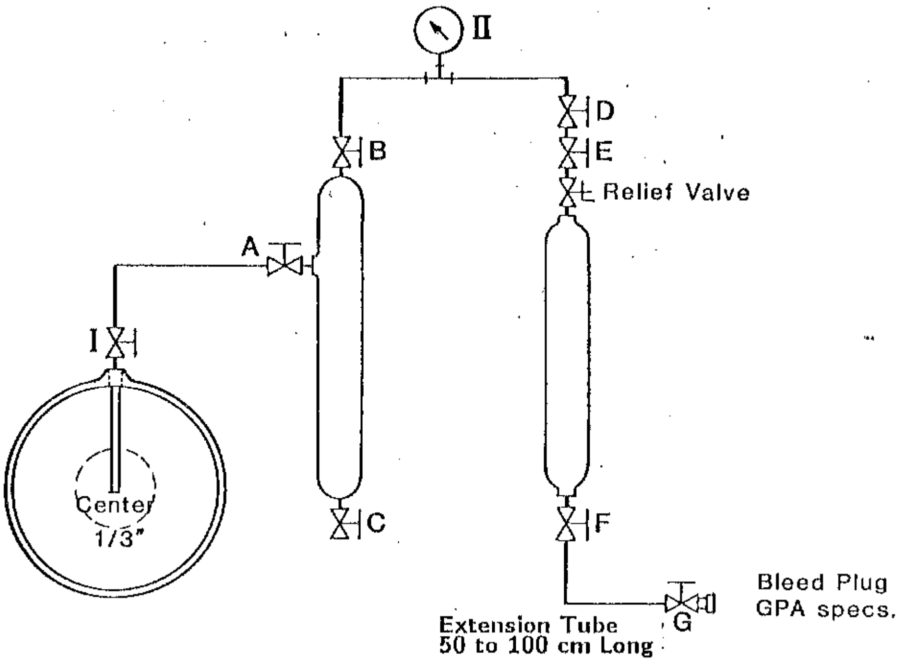
7. Open valve A to fill manifold with full pipeline pressure.

8. Open extension valve G. Allow pressure to bleed off. Close valve G.
(If at any time liquid appears at valve G the sample should be discarded)
Steps 7 and 8 constitute the fill and empty cycle and should be repeated as many times as indicated below, to condition the sample cylinder. The pipeline pressure being the determiner for the number of repeats.

Gas Pressure kPa	Number of Purge Cycles
100 - 200	13
200 - 400	8
400 - 600	6
600 - 1,050	5
1,050 - 3,500	4
over 3,500	3

9. At the completion of the required number of purge cycles, close valves E and F and probe valve I. Bleed the pressure from the manifold and extension tube. Remove the sample cylinder from the manifold and check for leaks. Plug the valves. Fill out the sample tag and transport the cylinder in a proper carry case.

II



2. **2. GPA CONTINUOUS PURGE METHOD.**

This method should not be used on wet gas or gas over 2,800 kPa.

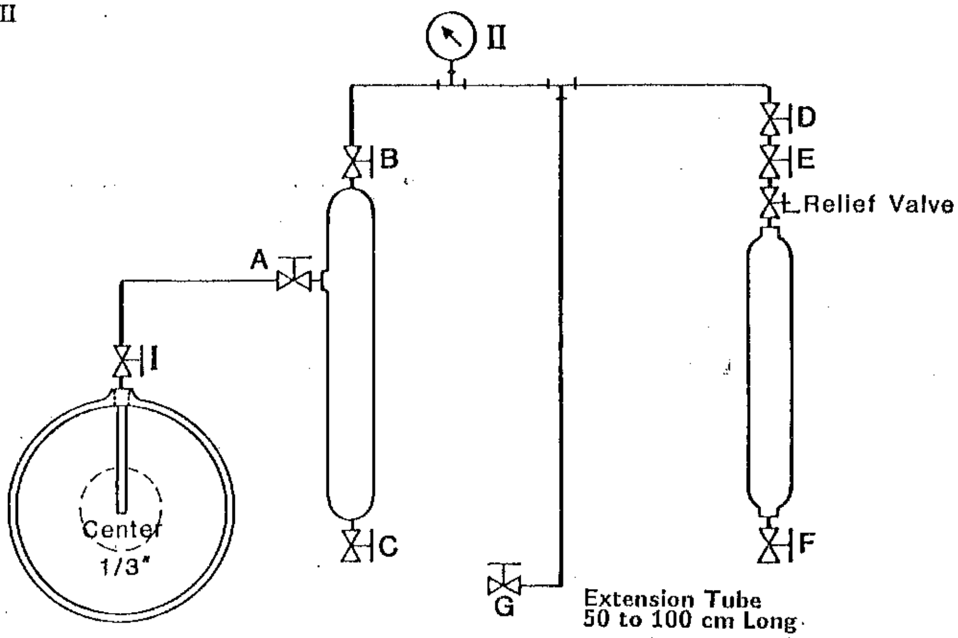
I. **Sample Probe**

II. **Sample Pressure Gauge**

Procedure:

1. Open valve I to purge the system of foreign matter in the probe or valve.
2. Connect sample manifold to prove I with all valves closed.
3. Slowly open valve valve I and then slowly, in sequence, open valves A, B, D, E, F and G. valve G must have a flow plug installed.
4. Allow gas to flow through the manifold for a minimum of 3 minutes. More time will be required if the cylinder has not been properly cleaned and dried.
5. After the specified time valves should be closed beginning with valve G then working towards the source valve F, E, D, B, A, I.
6. Bleed pressure from manifold and remove sample cylinder.
7. Check cylinder for leaks and plug the valves.
8. Plug the valves. Fill out the sample tag and transport the cylinder in a proper carry case.

III



3. GPA METHOD FOR TAKING A SPOT SAMPLE IN AN EVACUATED CYLINDER OR STANDARD CYLINDER FILLED WITH AN INERT GAS.

1. Evacuate a clean sample cylinder and plug valves.

2. Open probe valve I to purge the probe and valve of foreign material.

3. Connect manifold to probe valve I.

4. With all valves closed attach sample cylinder to manifold. Check the gauge to ensure sample cylinder is evacuated.

5. Open probe valve I and valves A and B with all other valves closed. Sample gauge II will indicate pipeline pressure.

6. Close valve A.

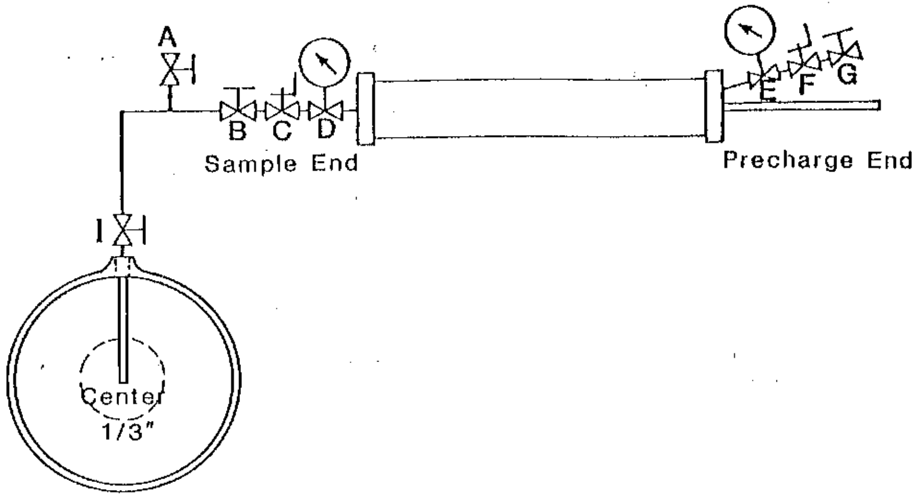
7. Open valve G on the extension tube to bleed the manifold pressure to 0.

8. Open valve A with valve B open, slowly open valve D and allow line pressure fill sample cylinder.

9. Close valve D. Close valve I. Open valve G to remove pressure from the sample manifold.

10. Remove sample cylinder from manifold. Check for leaks. Plug the valves. Fill out the sample tag and transport the cylinder in a proper carry case.

IV



4. DRAWING A SPOT SAMPLE INTO A CONSTANT PRESSURE (SLIDING PISTON) SAMPLE CYLINDER.

The sample cylinder should be precharged with gas at or above pipeline pressure.

Procedure. A.

1. Open probe valve I to clear probe and valve of foreign matter.

2. Connect tee manifold with vent valve A to probe valve I.

3. Connect sample cylinder inlet to tee manifold.

4. Open probe valve I, open sample inlet valve B. Line pressure will be indicated on sample gauge D.

5. Close probe valve I, open vent valve A, allow pressure to bleed to D.
Steps 4 and 5 constitute a purge of the inlet piping. This purge should conform with the guidelines of the fill and empty method, depending on the pipeline pressure.

6. After the inlet piping has been purged, the probe valve I should be opened.
Valve B is open and pipeline pressure is indicated on sample gauge D.

7. Slowly open the precharge valve G and allow the precharge gas to vent. This allows the sample to flow slowly into the inlet or sample end of the sample cylinder.

Procedure B.

This procedure utilises the pipeline gas as the precharge gas.

1. Open probe valve I to clear probe and valve of foreign matter.

2. Close all valves on cylinder and manifold assembly

3. Connect tee manifold with precharge valve P and isolation valve N.

4. Open probe valve I.

5. Open precharge valve P.

6. Open G precharge cylinder valve (Pipeline pressure on back of piston).

7. Open cylinder valve B and vent valve A. (This allows piston to move to the face of the inlet flange).

8. Close vent valve A, open isolation valve H.

9. Close isolation valve H, and open vent valve A.
   Repeat steps 8 and 9 to purge piping from pipeline to cylinder piston. Number of purges to conform with table appendix 1.

10. Close vent valve A.

11. Open isolation valve H.

12. Close cylinder precharge valve G and inlet precharge valve P, disconnect precharge tubing quick-connect.

13. Slowly and carefully open precharge valve G, allowing precharge gas to vent and piston to slowly move from the inlet to the precharge end of cylinder. (Piston may be stopped at any desired volume by closing valve G).

14. Close valve B (Cylinder Inlet).

15. Close all other valves. Disconnect precharge tubing.

16. Bleed gas off manifold and remove sample cylinder. Check valves for leaks. Install plugs in valves and put cylinder in an appropriate carry case.

Appendix B

Liquid Displacement Method of Sampling Liquid Hydrocarbons

1. The sample cylinder should be completely filled with the displacement liquid.

2. After purging the sampling line, connect the cylinder to the sample source vertically. If the cylinder is equipped with an outage tube, the tube end of the cylinder should be at the bottom.

3. With the sample cylinder valves closed, open the sample source valve to full-opened and observe the pressure on the sample header gauge. Slowly crack the fitting between the cylinder and the source to purge fittings and tubing.
   Do not allow the pressure to drop below the original sampling pressure. Discontinue the purge when product starts to appear.

4. Open the top valve on the cylinder to full-open.

5. Open the bottom valve on the sample cylinder slowly until a small stream of displaced liquid is allowed to flow from the bottom of the cylinder.

   If the cylinder is not equipped with an outage tube, a graduated cylinder or other measuring container should be used to collect the displaced liquid. Drain the displacement liquid slowly, making sure the the original sampling pressure is maintained

   Continue to displace liquid until the desired amount of sample has been transferred. This must not exceed 80% of the volume in the cylinder. close the bottom valve of the cylinder.

6. Close the top valve of the cylinder then the sample source valve. Relieve the pressure from the sample line.

7. The cylinder now contains approximately 80% hydrocarbons on the top end and 20% displacement liquid on the bottom. The cylinder should be disconnected and the remaining 20% displacement liquid drained from the bottom.

   If the cylinder is equipped with an outage tube, invert it so that the outage tube is at the top before draining the displacement liquid from the bottom.

   Under no circumstances should the cylinder be transported when full of liquid.

8. Because of the 20% outage, the cylinder now contains a sample in equilibrium. To force the product back into the liquid phase it must be repressurised with a liquid to a pressure greater than its vapour pressure before being injected into a chromatograph.

9. Check the valves for leaks, cap valves to seal and protect threads, prepare sample information tag and package for transport as per requirements.
   These cylinders should be provided with pressure relieving devices. They should not be exposed to extreme ambient temperatures to prevent pressure relieving, this would create a possible safety hazard and void any meaningful analysis.

SHIPPER'S DECLARATION FOR DANGEROUS GOODS

Shipper	Air Waybill No. Page of Pages Shipper's Reference Number *(optional)*
Consignee	
Two completed and signed copies of this Declaration must be handed to the operator	WARNING

TRANSPORT DETAILS

This shipment is within the limitations prescribed for *(delete non - applicable)*

PASSENGER AND CARGO AIRCRAFT	CARGO AIRCRAFT ONLY

Airport of Departure

Airport of Destination

WARNING

Failure to comply in all respects with the applicable Dangerous Goods Regulations may be in breach of the applicable law, subject to legal penalties. This Declaration must not, in any circumstances, be completed and/or signed by a consolidator, a forwarder or an IATA cargo agent.

Shipment type (delete non - applicable)

NON – RADIOACTIVE	RADIOACTIVE

NATURE AND QUANTITY OF DANGEROUS GOODS *(see sub - Section 8.1 of IATA Dangerous Goods Regulations)*

Dangerous Goods Identification						
Proper Shipping Name	Class or Division	UN or ID No.	Subsidiary Risk	Quantity and type of packing	Packing Inst	Authorization

Additional Handling Information

I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked and labelled, and are all in respects in the proper condition for transport by air according to the applicable IATA Dangerous Goods Regulations, Carrier's conditions and relevant International and National laws or Government Regulations.	Name / Title of Signatory Place and Date Signature *(see warning above)*