Annex A

NKK checklist for gas carrier intial survey

NIPPON KAIJI KYOKAI
日本海事協会

CHECK LIST FOR GAS CARRIER

(FOR INITIAL SURVEY)

液化ガスばら積船初回検査用チェックリスト

Applied Rule : International Code for the Construction and Equipment
of Ships Carrying Liquefied Gases in Bulk
(Including 1st to ー th Amendment)
適用規則　Part N of the Rules/鋼船規則 N 編

Name of Ship
船　　名 : ENNERDALE

Classification No.
船級番号 : 971159

Builder
造　船　所 : SHIN KOCHIJYUKO CO., LTD.

Hull No.
船　　番 : SNO. 7097

NK : Sakaide Branch/office

Date : 27 Mar. 1997

Signature :
(T. MATSUMOTO)

( )

Inspection Items 検査項目	Inspection Procedures 検査要領	Ship's Features 本船の状態	Judgement 判定
3.9 Emergency Shut Down System 緊急遮断装置 (5.6.1, 5.6.4)	ESD system should comply with the following requirements. ESD装置は下記の要件を満足すること.	(2) Remote control from／遠隔制御場所； ~~Wheel house' / Cargo control Room~~ ~~and~~ Cargo monitoring room, Cat walk	OK
	(1) Local closing is manual. 設置場所で手動閉鎖可能.	(3) Fuse element／ヒューズエレメント Design melting point : 98~104 °C	OK
	(2) Remote control from 2 positions. 隔った2箇所から遠隔操作可能.	(4) Fail-closing／フェールセーフ Signal…Hydro' ~~/ Pneu / Elect~~ or — Closing by…~~Hydro / Pneu~~ / Spring' or —	OK
	(3) Fuse element (98~104°C) at dome and manifold. ヒューズエレメント (98~104°C) をドーム部とマニホールド部に設置.	(5) Closing time／閉鎖時間 … actual 25 sec.	OK
	(4) Fail-closing. (To be tested) フェールセーフ (動力の消失で閉鎖). (試験する)	Type of ESD valve; ESD弁の型式;	OK
	(5) Closing time within 30 sec. (To be tested) 閉鎖時間は30秒以内(試験する)	Maker 製造者 : NAKAKITA SEISAKUSHO Co., LTD. Type 型式 : Cylinder & GLOBE	OK
	(6) To stop pumps and compressors automatically. (To be tested) ポンプ及びコンプレッサーを自動停止 (試験する)	Cert. No. 証明書番号 : FE-96 05-11047-18 FE-96 05-10327-24	OK

Inspection Items 検査項目	Inspection Procedures 検査要領	Ship's Features 本船の状態	Judgement 判定
7.1 Environmental Control within Cargo Tanks and and Piping Systems 貨物タンク及び管装置内の環境制御 〔9.1〕	(1) Piping systems should be provided to enable cargo tanks and pipings to be safely gasfreed and purged. 貨物タンク及び管装置を安全にガスフリー，パージできるような管装置を設けること.	(1) Pipe line for gas-freeing／purging ; ガスフリー／パージ用管 : Flow Diagram Dwg. No. V144-01 Cargo liquid line and vapour line are used for gas-free and purge operation.	OK
	(2) Efficient number of gas sampling points should be provided. Gas sampling connections should be valved and capped above the weather deck. 十分なガス採取端を設けること．採取端には暴露甲板上に弁及び蓋を設けること.	(2) Provided sampling nozzle as; Slip-tube gauge, Sampling nozzle on valve dome, Drain line.	OK
	(3) For flammable products, inert gas from I.G.G. or shore should be introduced into cargo tanks and pipings. 引火性貨物の場合，I.G.G. 又は陸上からのイナートガスを貨物タンク及び管装置に導入できること.	(3) Inert gas from ;／イナートガス供給 ; ……~~I.G.G.~~・／Shore・／~~Other~~ N_2 GENE. or S	OK

Annex B

Report on examination of gas sampling valve assemblies

MSI™

MSI-Defence Systems Ltd

Our reference: RH/5710P01 Your reference: 1/12/101 Date: 19 December 2006

Mr Nicholas Hance
MAIB,
First Floor, Carlton House,
Carlton Place,
Southampton.
SO15 2DZ

Examination of Gas Sampling Valve Assemblies

Dear Sir,

1.0 Introduction

1.1 Two (2) in number valve assemblies, cargo tank one (1) and cargo tank two (2), were supplied to MSI-DSL for investigation purposes. The valve assemblies were involved in a incident aboard MT Ennerdale where it is understood by MSI-DSL that during a routine gas sampling exercise the valve from cargo tank two (2) became detached from the cylinder assembly.

Figure 1: Typical Valve Assembly

10 Cambridge Road, Granby Industrial Estate, Weymouth, Dorset DT4 9XA
telephone: +44 (0) 1305 760111 fax: +44 (0) 1305 760222
e-mail: Weymouth@msi-dsl.com
website: www.msi-dsl.com

2.0 Inspection

2.1 Valve Assembly One

On receipt at MSI-DSL the valve assembly was visually inspected. The connecting threads appear in good condition and show no signs of deformation / corrosion. The male thread engages six (6) full threads when hand tight and has not bottomed out on the valve, allowing adequate threads for final wrenching.

Figure 2: Male Thread Tank 1

Figure 3: Valve Female Thread Tank 1

2.2 Valve Assembly Two

On receipt at MSI-DSL the valve assembly was visually inspected. The connecting threads appear in relatively good condition and show no signs of deformation / corrosion. The male thread engages fully within the valve body and bottoms out when only hand tight thus leaving no allowance for wrenching other than that gained when applying PTFE tape. Despite this the assembly can be tightened and should produce an adequate seal at the pressures required (believed to be 18 bar).

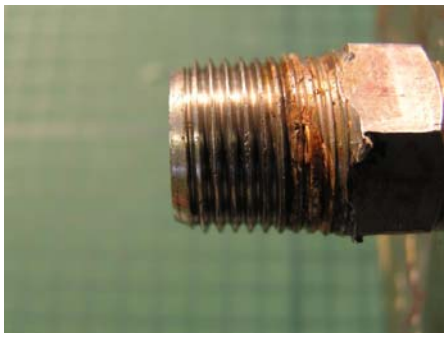

Figure 4: Male Thread Tank 2

Figure 5: Valve Female Thread Tank 2

10 Cambridge Road, Granby Industrial Estate, Weymouth, Dorset DT4 9XA
telephone: +44 (0) 1305 760111 fax: +44 (0) 1305 760222
e-mail: Weymouth@msi-dsl.com
website: www.msi-dsl.com

2.3 The threads were then measured and confirmed as R3/8 (3/8 BSP external taper thread) and Rc 3/8 (3/8" BSP internal taper thread) in accordance with;

- BS 21:1985 "Pipe threads for tubes and fittings where pressure-tight joints are made on the threads (metric dimensions)".

In accordance with BS 21:1985 a 3/8 BSP male thread should have 7.5 useful threads of which 2.75 threads are for fitting. Therefore the minimum engagement should be approximately 4.75 threads.

2.4 BS 21:1985 states that "This British Standard specifies requirements for the following pipe threads.
a) Jointing threads, which are pipe threads for joints made pressure-tight by the mating of the threads and are taper external, taper internal or parallel internal threads."

2.5 It should be noted that it is common practice to apply a jointing medium to the threads before assembly to ensure that a pressure-tight joint is made and to prevent galling of the threads.

2.6 All threads are full form and show no signs of damage indicating failure of the threads. There also appears to be no evidence of the threads being modified by filing or rethreading.

2.7 It should be noted that valve assembly one (1) was heavily coated in paint. This gives the impression that the male thread is engaged deeper in the valve body than it actually is. Valve two (2) had had its paint removed prior to receipt at MSI-DSL.

Figure 6: Valve Female Thread Tank 1

3.0 Conclusions

3.1 Given the above evidence and that the method used for attachment is a well known industry standard MSI-DSL postulate that the cause of the failure can be attributed to either;

- The rotation of the valve (i.e. unscrewing of the valve due to vibration / operation of the valve) whilst in situ.

Or

- Incorrect assembly, i.e. not tightened fully.

3.2 The subtle difference between the two male threads could be attributed to different manufactures however both thread forms conform to the British Standard and are therefore compatible with the female threads of the valve bodies.

4.0 Recommendations

4.1 MSI-DSL recommends that consideration be given to replacing the tapered threads with parallel threads using either o-ring or bonded seals. This would simplify both assembly and subsequent inspection.

4.2 Consideration should also be given to the provision of a mechanical locking device to prevent rotation of the assembly. This could be in the form of, but not limited to, a right angled bracket attached to the flange securing bolts or locking wire to prevent the rotation of the valve body.

4.3 Painting of the valve assembly should be avoided as it prevents thorough inspection during routine maintenance.

If you require any further information please do not hesitate to call.

Yours faithfully

Richard Hanney
Senior Engineer (Diving and Pressure Systems)

Justin Waller
Engineering Manager

10 Cambridge Road, Granby Industrial Estate, Weymouth, Dorset DT4 9XA
telephone: +44 (0) 1305 760111 fax: +44 (0) 1305 760222
e-mail: Weymouth@msi-dsl.com
website: www.msi-dsl.com

Annex C

Sampling section from ship’s SMS system

5.3.11 Sampling

Sampling of cargo is routinely carried out by terminal representative prior commencement of discharge. Sampling is carried out for two basic reasons:
To establish safe conditions before cargo transfer.

To establish that the cargo is within commercially agreed specification at the various points of cargo transfer.

This could be a hazardous situation as the terminal representative or Surveyor will not generally be familiar with the layout of the shipboard piping. Hence a competent officer thoroughly familiar with the pipeline layout of the vessel must always accompany the terminal representative.

It is generally accepted that sampling will always be associated with certain amount of disposal of vapour to the atmosphere for sample point purging and cylinder ullaging. The following safeguards should be followed:

In all cases venting, purging or ullaging of sample containers must be carried out in a safe area with due regard to prevailing wind and weather conditions.

When the sample being taken might have irritant hazard in addition to flammable hazards, then means should be provided to absorb or disperse the material in a safe area. For example in the case of ammonia, a hose could be provided to carry the vapour to a water surface or spray area.

When the sample might have toxic rates for instance VCM or butadiene then means should be provided to avoid release of the material to the atmosphere. In this case a closed loop system may be provided or obtained by connecting

outlet valve of the sampling container to a vapour sample connection point or vent system.

Certain cargoes are required to be carried under a nitrogen pad (propylene oxide, ethylene oxide or mixtures of them); product samples are therefore drawn only from the tank bottom or liquid space. The vapour space is sampled to ensure adequate nitrogen content.

The other hazard associated with sampling is accidental loosening of the sampling connection. This would not normally occur at the designated sampling points as safeguards have been incorporated at the design stage. However, from time to time, sampling is done from screwed down connections on the cargo piping. This is done particularly from a partly empty tank. In order to guard against this the flanged area of such connections should be temporarily secured with a length of rubber gasket and seizing wire. **Do not attempt to secure these by a tack weld**. The heat of the welding will definitely damage any Teflon seating in way of these connections and destroy their gas tight integrity.

A peculiar problem is associated with bottom sampling. This must always be done from the designated sampling point. Do not try to draw a sample from the sump drains. The content of the sump drain is never a representative sample of the cargo. It contains traces of many previous cargoes and water. In order to obtain a representative sample the entire length of the drain lines must be adequately vented. This problem can easily be avoided by drawing sample from the designated sampling points. Cargoes have in the past been rejected because of this.

Annex D

Ship’s ESD test log and relevant extracts of logbook

LPG/C ENNERDALE
Hongkong

E S D TEST LOG

Voy. No.	Date/ Time	Position	Condition of glands & actuator	Condition of system fittings	Response time (20-30 sec)	Remarks	OIC signature
35	20.08.06. 0735	SINES PORTUGAL	Good	Good	2.6 secs	TESTED PRIOR DISCH	
36	25.08.06 1513	HUELVA SPAIN	Good	Good	25 secs	TESTED PRIOR LOADING	
36	27.08.06. 1446	MOHAMMEDIA MOROCCO	Good	Good	25 secs	TESTED PRIOR DISCH	
37	03.09.06 0442	LA CORUNA SPAIN	Good	Good	24 secs.	TESTED PRIOR LOADING	
37	10.09.06 1630	PORVOO FINLAND	Good	Good	25 secs	TESTED PRIOR DISCH.	
001	24.09.06 0755	RIGA LATVIA	Good	Good	24 secs	TESTED PRIOR LOADING	
002	26.09.06. 1845Hrs.	GDANSK POLAND	Good	Good	26 secs	TESTED PRIOR DISCH	
003	05.10.06 0800	FAWLEY UK	Good	Good	28 secs.	TESTED PRIOR LOAD	
003	10.10.06 1105	LISBON PORTUGAL	Good	Good	27 secs	TESTED PRIOR DISCH	
003	12.10.06 2130	VLISSINGEN NETHERLANDS	Good	Good	28 secs	TESTED PRIOR DISCH	

31/7/06

KALUNDBORG, DENMARK **To/At** MOHAMMEDIA, MOROCCO **Voyage No.** 033

Berth ....

TOOK OVER WATCH FROM 3/OFF SMS CHECKLIST B.R.4 COMPLETED ALL OK
FIRE AND SAFETY ROUNDS OF PREVIOUS WATCH REPORTED ALL'S WELL

COMPASS ERROR VERIFIED

CLOUDY SKIES, GOOD VISIBILITY, ROUGH SEAS AND LOW SWELL. RELIEVED BY C/OFF
ON NOTED COURSE. GPS POSN: 54.12.3 N λ 004-59.8 E
2/O R
TOOK OVER CONN FROM 2/O SMS CHECKLIST BR4 COMPLETED, ALL OK
FIRE & SAFETY ROUNDS REPORTED BY PREVIOUS WATCH ALL WELL
GPS FIX φ 54.07.3 N 004.54.6 E A/C 180°T
EF RACON φ 041°T 5.4 A/C 200°T

OVERCAST SKIES, FRESH BREEZE, ROUGH SEA W/ GOOD VISIBILITY
WATCH RELIEVED BY 3/O [illegible]
C/O
Took over watch from C/OFF. Completed SMS BR4 Checklist. All's well.
Daily time check on ships clock & IC(T) error found & adjusted to zero.
GPS pos. φ 53-10.2 N λ 004-23.6 E A/co to 230°T
PRESSURE TEST CARRIED OUT ON STBD LIQUID MANIFOLD UP TO 10.5 BARS FOR 30 MINS NO LEAK

Cloudy skies, good visibility. Westerly fresh breeze, rough sea w/ moderate swell. Watch relieved by
2/OFF on noted course & GPS position φ 52-52.0 N λ 003-45.9 E All's well.
2/O [illegible]

NW ...... COURSE MADE GOOD (T.) 230 ...... DIST TO GO 1442 ...... ETA 05 AUG/0522H (12.5KTS)

251 ...... LOG % ERROR 13.15 ...... RPM 185.2 ...... % SLIP 19.3

Berth ....

TOOK OVER WATCH FR 3/OFF SMS CHECKLIST BR2 COMPLETED, ALL OK.
GPS POSN: 52-49.4 N λ 003-41.8E A/C TO 212°T
PRESSURE TEST CARRIED OUT ON CARGO TANK 1 & 2 FILLING LINE VALVE FOR 1 HR, NO LEAK
GPS POSN: 52-15.0N, λ 003-05.7E A/C TO 223°T

CLOUDY SKIES, GOOD VISIBILITY, ROUGH SEA AND LOW SWELL, RELIEVED BY C/OFF ON
NOTED COURSE. GPS POSN: 52-10.1N λ 002-58.0E
2/O R
TOOK OVER CONN FROM 2/O, SMS CHECKLIST BR4 COMPLETED, ALL OK

GPS FIX 51-54.2 N 002-34.7 E A/C 220°T

CLOUDY SKIES. GOOD VISIBILITY VSL MOVING TO HEAD SEA & SWELL ROUGH SEA
WATCH RELIEVED BY 3/O ALL'S WELL
3/O
Took over watch from C/OFF Completed SMS BR4 checklist. All's well.
Fire & safety rounds carried out by previous watch. Everything is OK

3/O

Overcast skies, good visibility. Northwesterly fresh to strong breeze w/ moderate swell.
Watch relieved by 2/OFF on noted course & GPS position. φ 51-04.4 N λ 001-27.3E. All's well.

Master [illegible]

18/8/06

From LAVERA | To/At [illegible] | Voyage No. 035

Narrative | Berth ....

TOOK OVER WATCH FROM 3/O COMPLETED THE BRG CHECKLIST, ALL OK
FIRE AND SAFETY ROUNDS AS PREVIOUS WATCH REPORTED ALL WELL

GPS POSN LAT 40-14.5 N X 004-55.E

CLOUDY SKIES, GOOD VISIBILITY, ROUGH SEA AND SWELL, VSL ROLLING HEAVILY AT TIMES. RELIEVED BY C/O ON NOTED COURSE. GPS POSN LAT 39-5_ N, X 004-5_ E 2/O

TOOK OVER WATCH FROM 2/O. BRG CHECKLIST COMPLETED ALL OK

FIRE & SAFETY ROUNDS REPORTED BY PREVIOUS WATCH ALL WELL

FAIRLY CLOUDY [illegible] ROUGH SEA [illegible] HEADING TO HEAD SEA & SWELL
WATCH RELIEVED BY 3/O AND WELL C/O

TOOK OVER WATCH FROM [illegible] [illegible]
[illegible]

PRESSURE TEST PORT & STBD MANIFOLD LIQUID LINE UP TO 15 BARS FOR 1.5 HRS. NO LEAKS.

[illegible] ROUGH SEA W/ MODERATE [illegible]
[illegible] X 00-PAGE [illegible] 3/O

State of passage

WIND DRIFT [illegible] COURSE MADE GOOD (T.) [illegible] DIST TO GO [illegible] ETA 20 AUG 1345H (12 KTS)

DIST 22[illegible] LOG % ERROR [illegible] RPM [illegible] % SLIP 21.2

Narrative | Berth ....

TOOK OVER [illegible] BRG CHECKLIST ALL OK

GPS POSN LAT [illegible]

PRESSURE TEST CARRIED OUT ON CARGO TANK 1 & 2 FILLING LINE VALVE FOR 1 HR, NO LEAK

CLOUDY SKIES, GOOD VISIBILITY, [illegible] SEA AND LONG SWELL. RELIEVED BY C/OFF ON NOTED COURSE. GPS POSN LAT 37 54 N X 006-16.5 W 2/O

TOOK OVER WATCH FROM 2/O AND BRG CHECKLIST COMPLETED ALL OK

GPS POSN / 37 3_ N [illegible] AC [illegible] PASSING [illegible]

FAIRLY CLOUDY SKIES, GOOD VISIBILITY, [illegible] SEA WITH [illegible]
WATCH RELIEVED BY 3/O [illegible] C/O

Took over watch from C/OFF, completed the BRG checklist. All ok.
Fire & safety rounds reported by previous watch & all found ok.
Retard ship's clock to the [illegible] ZD -1

Cloudy skies good visibility, [illegible] fresh breeze, rough sea w/ moderate long swell.
Watch relieved by 2/O on course [illegible] GPS [illegible] 3/O

Master [signature]

Pipework pressure test

Annex E

Check and maintenance manual for JIS 20 K ESD valve

CHECK AND MAINTENANCE MANUAL

TYPE. NS 650

OIL HYDRAULIC OPERATED

NAME CYLINDER VALVE

DRAWN/DATE 作成／日付	CHEK'D/DATE 照査／日付	APPRO'D/DATE 承認／日付
Y. Hiraishi APR. 16. 1999	S. Mori APR. 16. 1999	K. Ito APR. 16. 1999

NAKAKITA SEISAKUSHO CO.,LTD.
1-1 Fukono minami-machi Daito-City 〒574-0075
TEL. DAITO (072) 871 - 1331
NAKAKITA SEISAKUSHO DIT

No. TD1968-PS81(E)

INDEX PAGE

PERIODICAL CHECK AND MAINTENANCE ..... 3～4

REPAIRING ..... 5～7

PERIODICAL CHECK AND MAINTENANCE

CHECK ITEM	CHECK POINT	INSTRUCTION
AT OVERHAULING	1. Check any damage on seating surfaces.	If any damage appears, repair by Lapping to be carried out.
	2. Check a degree of senility, elasticity and crack on packing and gasket.	All packings and gaskets to be replaced possibly at overhauling.
	3. Check rust and pin-hole on valve disc and spring.	To be renewed if big damage is appeared.
	4. Check a degree of wear, corrosion and/or errosion on inner valve and guide parts.	To be renewed according to degree of damage.
	5. Check a degree of errosion on inner wall of body where comes into collision with fluid.	Check pressure difference because it is will be occured especially when high pressure drop observes.
MONITRING AT NORMAL OPERATTION	1. Check whether loads apply to the valve is with • in specified rated conditions.	Check with gauges.
EVERY DAY.	1. Check a leakage at gland and other sealing part.	Further fastening of bolts or fastener. (Fastener at gland and gasket.)
	2. Check a leakage of oil at sealing part of the actuator.	Further fastening of bolts or replacement with new packing or gasket.

PERIODICAL CHECK AND MAINTENANCE

CHECK ITEM	CHECK POINT	INSTRUCTION
EVERY WEEK	1. Check a degree of loosing at connection of stem.	Further fastening of bolt
	2. Smoothness of valve function	Check a jaming of scale at guide part and remove it.
EVERY 1 OR 2 YEARS	1. Check a degree of wear on Y packing on piston and sliding parts.	Replacement with new O rings.
	2. Check at joints for oil pipings and also all accessories.	To be replaced with new one if there is a damage.

CONDITION	ESTIMATED CAUSES	REPAIRING
VALVE IS INOPERABLE	1. Damage at power source or pressure drop due to a leakage on oil pipings.	Check at pump and oil piping, especially joint part.
	2. Leakage through Y packing on piston in the actuator or insufficient power due to broken of O ring.	Damaged O rings to be replaced with new one.
	3. Jaming foreign material in valve seats or sticking at stem and guide bush.	Overhauling valve body and check and re-maching or replacement with new parts.
	4. Increasing pressure of controlled fluid or pressure drop of operating oil pressure.	Check whether pressure at each point is maintained within specified range and also check accuracy of pressure gauges.
UNSTEADY FUNCTION OF THE VALVE	1. Increasing of pressure of controlled fluid or pressure drop dure to increase of oil consumption at another lines.	Maintain pressure of fluid within specified range and increase capacity of power source.
	2. Increasing friction loss at valve stem.	Check at gland packing and alignment of centering of valve stem. (especially attention to be payd for unbalanced fastening)
	3. Check proper installation for flow direction.	Correct mounting direction and confirm flow direction with arrow mark.

CONDITION	ESTIMATED CAUSES	REPAIRING
VIBRATION ON VALVE	1. Wearing inner valve or guide bush.	Renewed damaged parts.
	2. Unstable supporting jigs for the valve.	To be increased strength of supporting jigs or to be renewed.
	3. Check another vibrating sources adjacent to the valve.	Remove such causes.
VALVE FUNCTION IS DULL	1. Enfeebled spring losd. (Loss of spring power)	Replaced with new spring.
	2. Wearing of gland packing.	Replaced with new packing and applying lubricant.
	3. Found a leakage at actuator or stem seal.	Replaced with new O rings or new stem.
VALVE IS NOT CLOSED (INCREASE LEAKAGE)	1. Check a degree of errosion on valve seat.	Machining or lapping at seating part. Replaced with new seat if damaged part is inrepairable.
	2. Jaming a foreign material in between disc and seat.	Remove such foreign material.

CONDITION	ESTIMATED CAUSES	REPAIRING
LEAKAGE AT PACKING	1. Insufficient fastening.	Increase fastening power.
	2. Wearing of packing.	Replace with new one.
	3. Damage stem surface or inside of stuffing box, or corrosion on these parts.	Remachining by overhauling or replaced with new parts.

Annex F

Report of a working group on liquefied gas sampling procedures,
published by SIGTTO in 1989

SIGTTO

Society of International Gas Tanker
& Terminal Operators Ltd

REPORT OF A WORKING GROUP ON LIQUEFIED GAS SAMPLING PROCEDURES

REPORT OF A WORKING GROUP ON

LIQUEFIED GAS SAMPLING PROCEDURES

NOTICE OF TERMS OF USE

REPORT OF A WORKING GROUP ON

LIQUEFIED GAS SAMPLING PROCEDURES

SOCIETY OF INTERNATIONAL GAS TANKER AND TERMINAL OPERATIONS LTD

WORKING GROUP
ON LIQUEFIED GAS SAMPLING EQUIPMENT AND PROCEDURES

TERMS OF REFERENCE

1 The Working Group shall be called "The SIGTTO Working Group on Liquefied Gas Sampling Equipment and Procedures" and shall consist of representation from terminals, gas carriers and other organisations as many be considered appropriate. The Working Group shall elect its Chairman from its nominated participants and may co-opt additional participation as may be found desirable.

2 The Task of the Working Group shall be to develop a proposal and budget for a project defining with particularity the present problems and potential consequences involved in the taking of cargo samples from the tanks of liquefied gas carriers. The Group shall recommend short-term improvements and give long term criteria, all with the objective of minimising the potential risks involved in the cargo sampling of liquefied gas cargoes. The Working Group shall address the requirements for the standardisation of sampling equipment and the training of terminal, gas carrier and other personnel involved with sampling to a suitable minimum level.

3 The Working Group shall report to the SIGTTO General Purposes Committee to which Minutes of the Working Group meetings will be made available and to which the draft project proposal and budget will be submitted for approval.

4 The Working Group will complete its task as expeditiously as possible, conducting its affairs by correspondence as far as is efficient and practical. It will aim to submit a draft project proposal for approval by 1st May 1986.

5 The SIGTTO London Liaison Office will act as Secretariat to the Working Group and under the guidance of the Chairman will convene meetings as may be considered necessary.

6 If required by the SIGTTO General Purposes Committee the Working Group will extend its remit to include such requirements.

REPORT OF A WORKING GROUP ON LIQUEFIED GAS SAMPLING PROCEDURES

Summary

The Working Group first met on the 18th April 1986 and adopted the Terms of Reference, which are attached as Appendix I, and elected Capt. Peter Cooke as Chairman of the Group. Project proposals were approved by the General Purposes Committee and a survey was carried out obtaining data from some forty seven (47) LPG tankers and operating experience through Working Group members of four (4) major terminal operators.

It was soon apparent to the Group that both ship and shore independent internal sampling procedures are about to be generally covered by the relevant section of ICS Tanker Safety Guide (Liquefied Gas) on the one hand and by ISO Draft International Standard 4257 (Liquefied Petroleum Gases - Methods of co-opted membership of the BSI committee on this subject.

The Group has therefore sought and enjoyed close co-operation through direct participation of ICS representatives and with ISO activities through Secretariat co-opted membership of the BSI working committee on this subject.

It is agreed that provided internal sampling procedures on both ship and shore are carried out by trained personnel familiar with the environment and possessing fully compatible equipment for the task in hand, the risks are minimal. However, it was borne out by the survey that the risk of an incident is much greater when personnel are attempting to draw samples from areas unfamiliar to them, particularly if they attempt to use mis-matched connections. The requirements for shore representatives to draw samples from ship tanks is the most obvious and frequent example of this situation. In confirmation of this point, a member has advised of an incident occurring as recently as January 1988 in which a technician completely unscrewed a one inch ball valve from a pressurised tank of LPG. He had mistakenly identified the valve as the sampling point; fortunately the LPG release was rapidly contained.

The Working Group are unanimous therefore in stating that the adoption of Recommendation 1 for a standardised connection is the best improvement (available in the short term) to minimise the potential risks involved in the sampling of liquefied gas cargoes. Recommended 1 for a standardised connection is the best improvement (available in the short term) to minimise the potential risks involved in the sampling of liquefied gas cargoes. Recommendations 2-5 are made for consideration and application as operational circumstances and procedures permit.

Recommendations

1 Standard for sampling connection fittings

It is recommended that ships tank sample access point should terminate in a G½ female parallel threaded connector in accordance with ISO 228/1. The sampling equipment should terminate in a corresponding male connector*. An illustrative sketch is attached.

*This recommendatory note has also been incorporated into ISO/DIS 4257

Pipework or tubing up to the sampling connection should be robust enough to withstand marine service and up to 3.5 kg weight of an attached sample cylinder. The sampling connection should be isolated by two standard ball valves fitted at least one metre apart as a precaution against hydrate formation at the primary valve. The sampling connection locked so that it cannot be unscrewed by the normal action of making and breaking connections. There should be a clear space of radius 250 mm around the stub piece sampling connection to allow spanner access to the connection nuts and fitting of the sample cylinder. When not is use the stub piece should be fitted with a screwed plug incorporating a soft washer to protect the sealing face. The connection should be clearly labelled as to its origin, ie tank designation nd top, middle or bottom source. In fully refrigerated ships where it is necessary to use a discharge pump to obtain a sample, a standard connection point (as above) should be fitted on the pump discharge line.

2 The provision of closed loop sampling facilities

Sample containers should be constructed to a recognised standard and of metal suitable for the gas to be handled. The Working Group are unanimous in recommending the following design features:

(a) In all cases venting, purging or ullaging of sample containers must be carried out in a safe area with due regard to prevailing wind and weather condition.

(b) When the sample being taken might have irritant hazards in addition to flammable hazards, then means should be provided to absorb or disperse the material in a safe area, e.g. in the case of ammonia, a hose could be used to carry the vapour to a water surface or spray area.

(c) When the sample might have toxic risks, e.g. VCM, butadiene, then means should be provided to avoid release of the material to atmosphere, e.g. a closed loop system may be provided, or obtained by connecting the container outlet valve to a vapour sample connection point or vent system.

(d) Certain cargoes are required to be carried under a nitrogen pad (propylene oxide, ethylene oxide or mixtures of them), product samples are therefore only drawn from the tank bottom or liquid space. The vapour space is sampled to ensure adequate nitrogen content. Further advice is available from the IMO Gas Codes and the data sheets referred to in para. 4.2 below.

3 The standard/type of containers used to obtain and transport samples

Sample containers should be constructed to a recognised standard and of metal suitable for the gas to be handled. The Working Group are unanimous in recommending the following design features:

3.1 Containers should be fitted with inlet and outlet valves to permit “throughflow” purging with suitable inert gas prior to use. (Helium was recognised as being most suitable for use with gas chromatography analysis but with due regard to the high cot of helium, the use of nitrogen is also recognised as an accepted industry practice).

3.2 Containers should be fitted with an internal ullage tube to ensure that a safe working ullage could always be established for the particular liquefied gas being sampled.

3.3 A bursting disc suitably rated for protection of the sample cylinder should be fitted at the ullage tube end of the cylinder. This may be incorporated into the valve assembly by some manufacturers.

3.4 A connecting T-piece with bleed valve and suitable swivel should be attached to the sample cylinder inlet valve ending in a male connection stub with parallel thread G½ to ISO 228/1; this for presentation to ships corresponding female sampling connector point.

In connecting to the ship's sample point the required pressure seal is made by a metal or bonded washer fitted to the male connection, which seals against the surface surrounding the threads of the female port.

NB The seal is NOT made on the thread.

4 The procedures involved in taking samples

4.1 In all cases, guidance given in the redraft of ISO 4257 should be observed with reference to protective clothing, gloves, goggles and breathing apparatus. This is standard guidance (as originally contained in BS 3195)

4.2 As laid down under Chapter 18.1 of the IGC Code, it is imperative that all concerned are properly informed of the nature of the crgo being handled and the precautions to be observed. This should include a full description of the physicl and chemical properties, countermeasures against accidental personal contact, firefighting and other emergency procedures.

This information should be available and promulgated in the form of industry Data Sheets, such as "HAZCHEM" or "TREM" cards from terminal, or as included in the appendix to the ICS publication "Tanker Safety Guide (Liquefied Gas)", etc.

4.3 A responsible officer should be present when any sample is being drawn from ship's tanks by a terminal representative or third party inspector. The officer should be fully conversant with all aspects of the ships sampling system including the operational characteristics of all valves. He should clearly recognise that his duty is to ensure that sampling is authorised and carried out in a safe manner, regardless of who is actually performing the sampling operation.

4.4 When drawing liquid samples it is imperative that sufficient ullage or vapour space is left in the sample container to allow for liquid expansion due to the temperature increasing to ambient.

Proper ullage will be confirmed if the sample container is held upright after filling (ie ullage tube at the top) and the top valve opened until only vapour (rather than liquid) is emitted.

5 Principles involved in the basic need to obtain samples

It was agreed that sampling was carried out for two basic reasons:

(i) To establish safe conditions prior to cargo transfer.

(ii) To establish that the cargo is within commercially agreed specifications at the various points of custody transfer.

As such, it was felt that variations on sampling requirements resulted from prevailing production specifications and customer's requirements. It was therefore agreed that the Working Group could only usefully advise on methods, procedures and standard for connections. The principles of sampling, the level and number of samples required and receiving tank condition stipulations were felt to be commercial matters for the contracting parties to agree upon.

Nevertheless, it was also agreed that where the producer and buyer had agreed upon sampling requirements, specifications and appointed surveyors, etc, there was often lack of information provided to the carrier of the cargo. For example, many consignments of LPG were carried as fuel

gas and provided that calorific value was maintained, there was no specific sensitivity to many impurities. Another consignment of LPG may be destined for cavern storage and therefore have a receiver's specification for maximum methanol content to protect underground permafrost or water table conditions. It is obviously in the interest of all parties, therefore, that conditions and

sensitivities, as well as the general description and hazards of the cargo, are made know to those responsible for storage, transfer or carriage.

It is the absence of such information exchange and cooperation that leads to each of the parties requiring their own samples, which is clearly an unnecessary increase of potentially hazardous activities. The necessity for sampling should always be minimised by cooperation resulting in the analysis of an agreed representative sample being accepted by all interested parties. In terminal loading systems, the use of automatic sampling devices may further reduce the requirements for manually drawn samples.

Conclusion

The Working Group believe that they have developed recommendations on all that can be practically and effectively accomplished in the short to medium term. They therefore submit their report for approval and, if agree, that the Recommendations be circulated to the Members.

The Working Group members would be pleased to consider further studies as an when the GPC believes it would be beneficial to re-open longer term issues.

ACTUAL SIZE ILLUSTRATION OF RECOMMENDED CONNECTION