

CHEMTANE 2
Standard Operating Procedure (S.O.P.)

This standard is issued for the purpose of ensuring safe and proper operation and maintenance of Chemtane 2 and gas equipment.

This S.O.P. does not detract from, nor supersede, any of the requirements of the Mines Health and Safety Act, the Minerals Act and Regulations and shall be read in conjunction with the Acts and Regulations. This S.O.P. establishes the general principles for the protection of persons from injury and illness and for the protection of property and equipment from damage that can arise from brazing, heating and cutting processes.

This S.O.P. is aligned to the SANS 10238 wherever applicable and possible.

This S.O.P. needs to be reviewed every 2 years or sooner if the need arises.

February 2020



This S.O.P. was compiled by Gas Safety International (Pty) Ltd. (GSI)

R. Lawrence - ENG. WELDING

K.P. Rohlssen – ENG. AUTOMOTIVE

Date: 27 January 2020

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Relating documents to this S.O.P. (For reference purposes)

1. The Mine Health and Safety Act (29, 1996)
2. The Minerals Act and Regulations (50, 1991)
3. SANS 2503: 2007 – Gas welding equipment – Pressure Regulators for gas cylinders used in welding, cutting and allied processes up to 300 bar
4. SANS 10019 – Transportable containers for compressed, dissolved and liquefied gases – basic design, manufacture, use and maintenance
5. SANS 3821 – Gas welding equipment – Rubber hoses for welding, cutting and allied processes
6. SANS 1156 – Gas welding equipment – Rubber hoses for welding, cutting and allied processes
7. SANS 10238: 2005 – Welding and thermal cutting processes – Health and Safety
8. EN: ISO 5172 – Torches (Blowpipe)
9. SANS 1237: 2007 – Single-stage regulators for liquefied petroleum gas (LPG)
10. SANS 50730-1: 2004 – Gas welding equipment safety devices. Part 1: - incorporating a flashback arrestor
11. AS 4332: 2004 – The storage and handling of gases in cylinders
12. AS 4839: 2001 – The safe use of portable and mobile oxy-fuel gas systems for welding, cutting, heating and allied processes.
13. Annexures.

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1. User of Oxy-Fuel Equipment

- 1.1 Must be trained, competent and authorised to use oxy fuel gas as specified in the S.O.P.
- 1.2 Be aware of personal responsibilities when using oxy-fuel gas.
- 1.3 Stop work if there is any level of discomfort with the safety on the job.
- 1.4 Report to your Supervisor if there are any problems in the implementation of this S.O.P.
- 1.5 Undertake a Job Safety Analysis (JSA) prior to any oxy fuel gas task.
- 1.6 Check with the Supervisor if there are any additional safety requirements (e.g. a Permit to work) associated with the task.
- 1.7 Carry out responsibilities as per this document.

2. Training

- 2.1 Management shall ensure that users / operators are trained in this standard for the safe use and operations of the gas brazing and thermal heating and cutting equipment, as stipulated in SANS 10238, Par. 4 under Responsibilities point 4.1.1.
- 2.2 Management shall ensure that the hazards involved in the use of gas brazing, thermal cutting and heating and consumables are identified and communicated to the users.
- 2.3 The level of training required is outlined below:

Level 1	Persons who assist personnel with Level 2 GSI training and Level 3 GSI training qualifications, all apprentices from all trades, personnel who assemble and disassemble oxy-fuel equipment, illiterate personnel or any person required to be a Buddy.
Level 2	Apprentice boilermakers and any person who will be using oxy-fuel equipment to perform work, but under the supervision of someone with Level 3 GSI training.
Level 3	All artisans who use oxy-fuel equipment or supervisors, who at any time,

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	will have level 2 GSI training or level 3 GSI training, personnel working under their supervision and personnel who perform hot work using oxy-fuel / gas equipment.
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3. Safety Procedures

The responsible person will ensure that a base line risk assessment and subsequent issue-based risk assessments with the relevant procedures and controls are implemented in his area of responsibility.

4. Safety Procedures in Non-Designated Areas

Management shall establish safety procedures for gas brazing, heating, cutting and thermal processes. The responsible person shall authorize, and be responsible for brazing, heating and cutting operations in areas not specifically designated or approved for such purposes.

5. Contractors

Management shall select contractors that have trained all their supervisors, safety officers and operators of oxy-fuel gas equipment and found competent in terms of this S.O.P. by management. The equipment used by the contractors shall meet the requirements of this S.O.P. Management shall advise contractors of any flammable materials or hazardous conditions of which the contractors may be unaware and any standard and procedures associated with the work they will be performing e.g. confined spaces and hot work permit, etc.

6. Confined Spaces

Management shall ensure that no brazing, heating or cutting takes place in confined space or underground without the authority of the responsible engineer or as prescribed by the companies' procedures. Management will ensure that the necessary controls are in place before signing any permit.

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7. Hot Work Permit

Management will put in place a hot work permit system to ensure that the necessary controls are put in place before any work is carried out in a hazardous area or for work deemed to be dangerous and requiring special precautions.

8. Underground / Hazardous Areas

Management will put in place a hot work permit system as per the Mine Health and Safety Act, (Act No 29 of 1996 as amended) to ensure that the necessary controls are put in place before any work is carried out underground.

9. Stored Energy

Check for all energy sources before the commencement of work and ensure the energy is isolated and locked out.

10. Equipment

10.1 Approved Equipment

Management shall ensure that equipment, such as gas brazing and heating torches, regulators, gas cylinders, trolleys, hoses and associated equipment and personal protective clothing, is used for its intended purpose and meet the requirements of this S.O.P.

10.2 Equipment Operation

All equipment shall be operated in accordance with this S.O.P.

10.3 Equipment Maintenance

All brazing, heating and cutting equipment shall be maintained in good working order and inspected on a scheduled basis as per this S.O.P. and if found to be defective (incapable of reliable, safe operation), the equipment shall be withdrawn from service until repaired by the OEM (no one shall be permitted to modify / repair or tamper with any gas equipment or safety devices).

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10.4 Safe Use of Equipment

Management shall be responsible for the training, testing and finding competent the users / operators for gas equipment and for the safe handling and storage of the gas equipment.

11. Risk Assessment

The use of oxy-fuel gas will undertake a formal risk assessment for all aspects of oxy-fuel gas usage. The risk assessment must be reviewed and approved by management.

12. Combustibles

Management shall determine what combustible materials and hazardous areas are present or likely to be present in the workplace. They shall take the following actions to ensure that combustibles are not exposed to ignition:

- 13.1 Has the work moved to a location free from combustibles or away from hazardous areas; or
- 13.2 Has the combustibles moved to a safe distance as identified in the risk assessment from the workplace or effectively shielded against ignition.

13. Protective Equipment and Fire Protection

- 13.1 Management shall ensure that appropriate protective equipment is used. Management shall ensure that the correct and adequate fire-protection and fire-extinguishing equipment is properly located at the site, hot work authorization procedures are followed and the operations are trained in the use of the fire equipment.
- 13.2 Within half an hour (or as stipulated by the site procedures) after the completion of gas equipment operations a competent person shall do an inspection on the site to detect and extinguish possible smouldering fires.

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14. Hot Work Permit / Confined Space / Underground

14.1 Management shall ensure that no work shall take place in confined spaces / underground or in any hazardous area as identified in the S.O.P. without obtaining a confined space/hot work permit and that the controls identified are in place before any work is commenced.

14.2 Management shall ensure that an appropriate Gas Detecting Instrument (GDI) is used to detect any gas presence, e.g. gas leaks etc.

15. Protection of Equipment

15.1 Gas equipment and other apparatus shall be so situated that they do not present a hazard to personnel in traffic areas, passageways, ladders or stairways. Good housekeeping shall be maintained at all times.

Special attention shall be given where overhead crane operations are carried out.

15.2 When the oxy-fuel gas cylinders / trolleys are not in view of or not within easy reach or as identified in the risk assessment / S.O.P. an assistant / buddy system is required to stand at the cylinders to close off the cylinders in case of an emergency.

16. General

16.1 Protective clothing for any welding and cutting operation will vary with the size, nature and location of the work to be performed. All effort shall be made to ensure that all oxy-fuel equipment shall be free from oil, grease and hydro-carbons. Flame retardant clothing shall be worn during cutting, heating or brazing operations. Materials that can melt and cause severe burns shall not be used as protective clothing near gas, brazing heating areas e.g. nylon, polyester, etc.

16.2 NOTE: Pockets should be emptied of flammable or readily combustible materials. Trousers should overlap boot/shoe tops to prevent spatter from getting into shoes/boots. Frayed clothing is particularly susceptible to ignition and burning and should not be worn during welding or cutting operations.

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16.3 Gloves

Leather gloves with a minimum of 250mm cuff shall be used to protect the hands and wrists. Insulated linings shall be used to protect hands exposed to high radiant energy. The length of the cuff required shall be determined by the management.

16.4 Aprons

Appropriate aprons to protect the front of the body shall be used as identified in the S.O.P.

16.5 Leg Guards

Flame-resistant leg guards shall be used as identified in the S.O.P. to provide added protection to the legs and feet.

16.6 Welders Yokes

Welder's yokes or shoulder covers with bibs shall be worn, as identified during the S.O.P., during overhead brazing or cutting.

16.7 Eye Protection for thermal processes

Only approved eye protection shall be worn that reflects UV rays (BS 675). In the event of overhead cutting a full-face shield shall be worn in addition to the eye protection glasses.

16.8 Hearing Protection

Ear plugs or equivalent protection, shall be used where noise hazards exist.

17. Ventilation

17.1 Adequate Ventilation / Extraction

17.1.1 Adequate ventilation / extraction (natural or mechanical) shall be provided for all gas cutting, heating and brazing.

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17.1.2 The operators of oxy-fuel gas equipment shall take precautions to avoid breathing the fumes / plume directly. This can be accomplished by the positioning of the work or by ventilation that directs the plume away from the face. If this is not possible an appropriate mask as required by the S.O.P. shall be used.

17.2 Environment for use of Gas Equipment

No gas brazing, heating or cutting shall be carried out unless the atmosphere is non-flammable and any combustibles or easily vaporized chemical agents have been moved away or protected from possible ignition or heating, like containers that have been used to store flammable liquids, fuel and oil tanks of earth moving equipment etc.

17.3 Brazing, Heating or Cutting Near Combustibles

When brazing or cutting is carried out near combustibles, non-flammable guards shall be used to protect the combustibles or its containers from heat and sparks.

18. Fire Protection

18.1 Fire Prevention

Where required, as identified through a risk assessment, a competent person or persons in firefighting shall be assigned to work with operators to extinguish any fires resulting from gas brazing and cutting operations.

18.2 Hot Work Authorization

Before welding or cutting operations are carried out in locations not designed for such purposes, the hot work permit procedures and authorization shall be followed.

Authorization may only be granted by persons who are Subject Matter Experts (SME).

18.3 Cutting of Containers that have Contained Flammables

No brazing, heating or cutting of containers (which include jacketed vessels, tanks, drums or other similar items that have contained flammable materials may take place.

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19. General

19.1 Brazing, heating and cutting operations pose hazards with regard to fumes, gases and heat. The workforce should be warned against these hazards and the MSDS be available and all affected persons trained in the MSDS information and on the suggested first aid treatment.

19.2 Labelling for Gas Cylinders

In order to designate types of gases stored (full or empty) the appropriate labels should be posted in conspicuous places to designate the different gases.

19.3 Labelling for Hazardous Materials

A number of potentially hazardous materials are used in the fluxes, coatings, covering and filler metals used in gas brazing, heating and cutting are released into the atmosphere during welding and cutting. Each component of a potentially hazardous material shall be identified on the up-to-date MSDS.

19.4 Labelling for Brazing Filler Metals Containing Cadmium and / or Zinc

Brazing filler metals containing cadmium and/or zinc should carry the relevant information on tags, boxes or other containers. Cadmium and/or zinc is one of the more hazardous ingredients of filler metals and should be prominently labelled as such. And up-to-date MSDS must be available.

19.5 Labelling for Brazing and Gas Welding Fluxes Containing Fluorides / Boron

Containers of brazing and gas welding fluxes containing fluorine / boron compounds should have labels or tags carrying cautionary information indicating that the contents contain fluorine / boron compounds.

Warning, Boron is highly flammable!

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20. All gas equipment shall be checked for gas tightness after assembly and before the torch is lit. Open flames (lighters) shall not be used for leak testing. Leak test solutions for use on oxygen and fuel gas connections shall be hydrocarbon free.

NOTE: Safety sprays or any other solution / liquids shall not be sprayed inside of hoses or connections to ease assembly.

20.1 Confined Spaces

Prior to the commencement of work in confined space adequate ventilation shall be provided as per S.O.P. to minimize the possibility of gas accumulation in confined spaces because of leaks or improperly closed valves after gas brazing, heating or cutting has been completed. The torch valves shall be closed and, in addition, the fuel gas and oxygen supply to the torch shall be positively shut off at a point outside the confined space. Whenever a torch is not going to be used for a substantial period of time, such as during lunch or overnight, the torch and hoses shall be removed from the confined space.

21. Flashback Arrestor, Hose Check Valves or Quick Couplings (SANS 50730-1) S.O.P.

Only approved flashback arrestors and quick couplings, as detailed in this S.O.P., shall be used in an oxy-fuel gas brazing, heating and cutting torch system. The devices shall be used and maintained in accordance with the manufacturer's instructions.

22. Pressure-Reducing Regulators (SANS/EN/ISO 2503-2007)

22.1 Approvals

Only pressure-reducing regulators approved by an independent QA authority shall be used as detailed in this S.O.P.

22.2 Liquefied Petroleum Gas (LPG) Regulators

LPG regulators shall comply with the requirements as stipulated in this S.O.P and be used only for the gas and pressures for which they are labelled.

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22.3 Regulators shall not be interchanged among designated gases

Regulators designed for and manufactured for specific gases, shall not be interchanged with other gases, e.g. Hydrogen, Acetylene and LPG.

23. Gas Cylinders

23.1. LPG Cylinder Valves

Only LPG cylinders that incorporate the pressure relief outlet valve shall be used.

23.2 Damaged Cylinders

Cylinders suffering from severe damage, corrosion or exposure to fire shall be returned to the supplier. Any dent in a cylinder exceeding 10mm shall not be used and sent back to the supplier with appropriate labelling for information to the supplier.

23.3 Gas cylinders shall be stored in a well-ventilated area and secured. Cylinders shall not be stored in a closed container or confined space.

24. Protection

24.1 Cylinders shall be stored in assigned places away from pathways (at least 1,5m away), elevators, stairs or gangways in locations where they will not be damaged by passing or falling objects. Cylinders in storage shall be adequately secured to prevent falling. Fuel gas cylinders shall not be stored within 1m of an electric power point, drains, open pits or anywhere, where gas can accumulate.

24.2 Cylinders Stored Separately from Combustibles and Oxygen

Cylinders in storage shall be separated from flammable and combustible articles/liquids and from easily ignitable materials (such as wood, grass, paper, packaging materials, oil and grease) by means of a non-combustible barrier of a height of at least 1,6m and that is fire resistant for at least half an hour, or shall be stored at least 5m away from such combustible materials.

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25. Chemtane 2 Cylinders

25.1 Chemtane 2 gas cylinders shall be stored upright and shall not be in direct sunlight.

25.2 All Chemtane 2 cylinders shall be transported in the vertical position and safely secured.

26. Precautions for Chemtane 2 gas

26.1 The cylinder content is not expressed in pressure (kPa) but in weight (kg) as the pressure inside the cylinder is determined by temperature only. The following additional precautions apply where Chemtane 2 is used.

26.1.1 Chemtane 2 is supplied in cylinders in liquid form with vapour above the liquid, cylinders should therefore be kept upright at all times.

26.1.2 The cylinder valve shall be opened slowly as rapid withdrawal can lead to static electricity or spark.

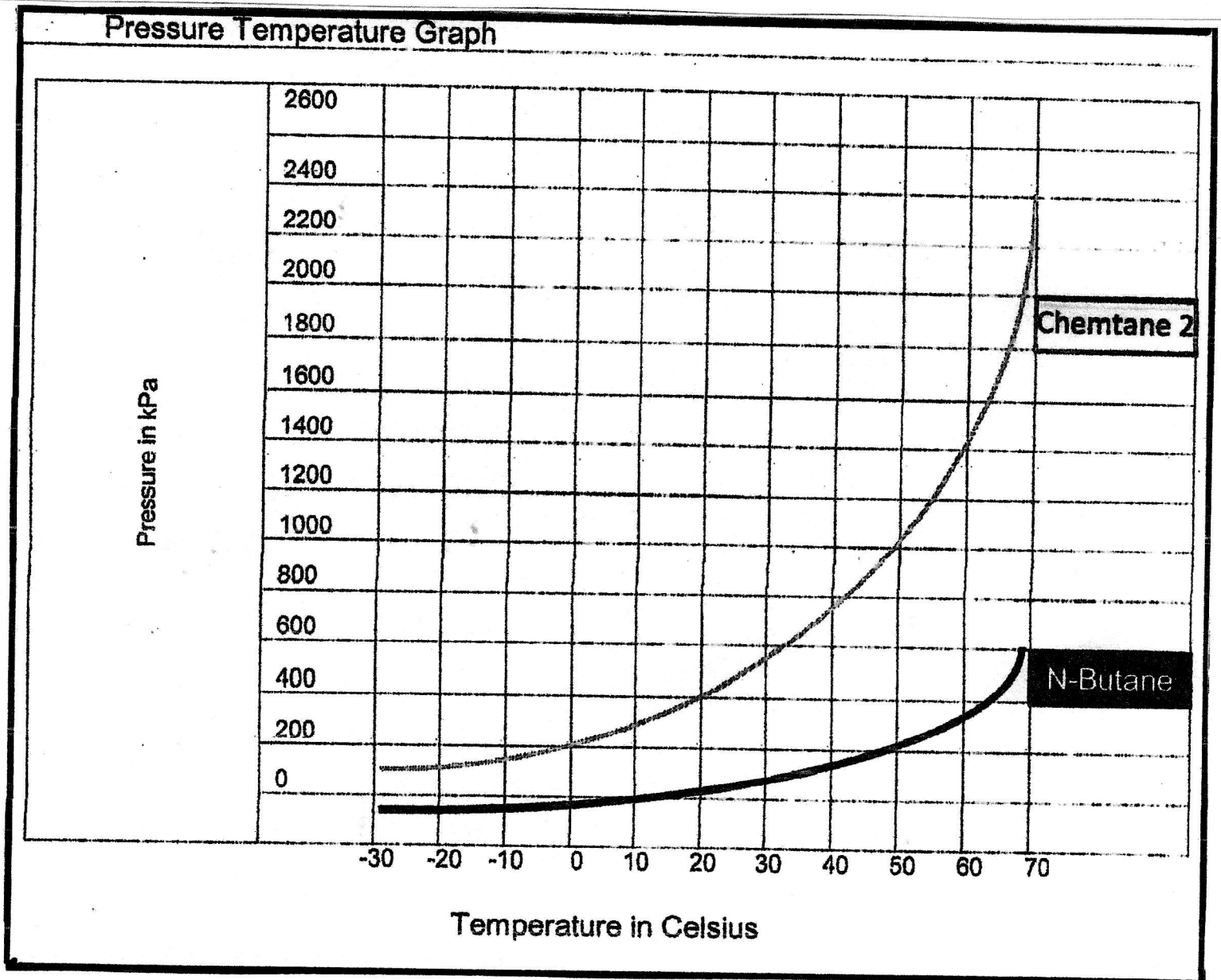
26.1.3 The correct regulators and hoses as per this S.O.P. shall only be used.

26.1.4 De-canting of Chemtane 2 from large cylinders to small cylinders is strictly forbidden.

26.1.5 Ensure all connections are leak proof as the gas is heavier than air and therefore difficult to detect.

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ANNEXURE A



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ANNEXURE B

Analytical Chemistry and Computer Modeling

Standard values were obtained from the literature. Tests were also conducted to fully characterize Chemtane 2 cutting fuel combustion properties. Temperature measurements were made by indirect thermocouple thermometry in a closed refractory lined chamber of known heat capacity. Effective heat content was measured versus the enthalpy of propane.

Maximum Flame Temperature: CHEMTANE – OXYGEN	3315 °C	6000 °F
CHEMTANE – AIR	1950 °C	3542 °F
Effective Heat Content of Gas @ 60 °F (15.6 °C) and 1 atm:	104.29kj/l 57,783kj/kg	2810 BTU/cu ft 24,812 BTU/lb
Volume of Gas Produced from Weight of Liquid:	551.24 cm ³	8.83 ft ³ /lb
Density of Gas:	(@0 °C (32 °F)) (@15.6 °C (60 °F))	1.91 g/cm ³ 1.81 g/cm ³
Specific Gravity of Gas (compared to air):	(@ 0 °C (32 °F))	1.5
Effective Heat Content for Liquid:	26,559 kj/l	106,000 BTU/gal
Heat of Vaporization @ 1atm & boiling pt.:	418 kj/kg	180 BTU/lb
Density of Liquid: (@ 15.6 °C, 60 °F)	0.505 g/cm ³	4.24 lb/gal
Specific Gravity of Liquid (compared to water):	0.505 @ 15.6/15.6 °C	(60 °F)
Stoichiometric Ration:	3.58 kg Oxygen/kg Fuel (3.58 lb Oxygen/lb Fuel)	
Typical Oxygen/Fuel Ration for Cutting:	20 ft ³ Oxygen / 6 ft ³ Fuel (per hr)	
Vapor Pressure:	(@23.75 °C, 70 °F) (@37.78 °C, 100 °F) (@61.25 °C, 130 °F)	8.8 kg/sq cm 15.3 kg/sq cm 17.2 kg/sq cm
		125 psig 218 psig 288 psig
Flash Point:	-101 °C	-150 °F
Explosive Limits:	IN AIR: IN OXYGEN:	LEL 2.3 % LEL 2.3 % UEL 9.4 % UEL 54.6 %
Boiling Point:	-42 °C	-43.6 °F
Freezing Point: (from CRC Handbook)	-185 °C	-302 °F
Note: To convert Joules to Cal. Gm. Multiply joules by 0.239		

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ANNEXURE C

Chemtane Energy LLC

Safety Data Sheet
Chemtane 2 Blended in Propane

Creation date: February 2020

Revision date: February 2022

Version 1.1

SP / E

SECTION 1: Identification of the substance/mixture and of the company/undertaking**1.1. Product identifier****Product name**

Chemtane 2 / Formulated by Chemtane Energy LLC

EC No (from EINECS): 203-692-4 CAS no: 109-66-0

Index-Nr

REACH Registration number: Not Required

1.2. Relevant identified uses of the substance or mixture and uses advised against**Relevant identified uses**

Industrial and professional.

Uses advised against

Consumer use.

1.3. Details of the supplier of the safety data sheet**Company identification**

Chemtane Energy LLC, Suite 3

10902 Interstate-10 East, Baytown, TX 77523

Contact in EU: inmasegarra@gdaparatos.come-mail address info@chemtane.com**1.4. Emergency telephone number**

Spill Chemtrec (800) 424-9300

Health emergency National Institute of Toxicology:
0034915628469**SECTION 2: Hazards identification****2.1. Classification of the substance or mixture****Classification acc. Regulation (EC) No 1272/2008/EC (CLP/GHS)**

Flammable liquid: Flam .Liq 1-Extremely flammable liquid and vapor

Aspiration hazard: Asp. Tox. 1 – May be fatal if swallowed and enters airways

Specific target organ toxicity - single: STOT SE 3 – May cause drowsiness or dizziness

Aquatic Chronic 2 - Hazardous to the aquatic environment –

Toxic to aquatic life with long lasting effects

Classification acc. to Directive 67/548/EEC & 1999/45/EC:

F+; R12 | Xn; R65, R66, R67 | N; R51/53

Extremely flammable.

Harmful: may cause lung damage if swallowed.

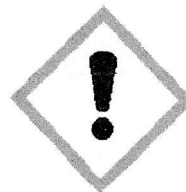
Repeated exposure may cause skin dryness or cracking.

Vapours may cause drowsiness and dizziness.

Toxic to aquatic organisms, may cause long term adverse effects in the aquatic environment.

Risk advice to man and the environment

Contact with liquid may cause cold burns/frost bite

2.2. Label elements**-Labeling Pictograms****- Signal word**

Danger

- Hazard Statements

H224

H304

Extremely flammable liquid and vapour
May be fatal if swallowed and enters airways

H336

H411

May cause drowsiness or dizziness.
Toxic to aquatic life with long lasting effects.

EUH066 Repeated exposure may cause skin dryness or cracking.

- Precautionary Statements**Precautionary Statement Prevention**

P210

Keep away from heat/sparks/open flames/hot surfaces. - No smoking.

P233

Keep container tightly closed.

P240

Ground / bond container and receiving equipment.

P241

Use explosion-proof electrical, ventilating, and lighting equipment.

P242

Use only non-sparking tools.

P243

Take precautionary measures against static discharge.

P261

Avoid breathing mist / vapours.

P271

Use only outdoors or in a well-ventilated area.

P273

Avoid release to the environment.

P280

Wear protective gloves and eye / face protection.

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ANNEXURE D

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Precautionary Statement Response

P301 + P310	IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
P303 + P361 + P353	IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
P304 + P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P312	Call a POISON CENTER or doctor/physician if you feel unwell.
P331	Do NOT induce vomiting.
P370 + P378	In case of fire: Use water fog, foam, dry chemical or carbon dioxide (CO ₂) for extinction.
P391	Collect spillage.

Precautionary Statement Storage

P403 + P233+ P235	Store in a well-ventilated place. Keep container tightly closed. Keep cool.
P405	Store locked up.

Precautionary Statement Disposal

P501	Dispose of contents and container in accordance with local regulations.
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2.3. Other hazards

Contact with liquid may cause inflammation or dry skin.

SECTION 3: Composition/information on ingredients**Substance / Mixture: Mixture.****3.1. Substances**

Name	EC No.	CAS No.	Content	Classification
Propane	74-98-6	200-827-9	> 99 %	
n-Pentane	203-692-4	109-66-0	> 1 %	
Isohexanes	232-443-2	8030-30-6	> 1 %	
2-Propanol	200-661-7	67-63-0	> 1 %	
Soltrol	70024-92-9	1068551-16-6	> 1 %	
Cyclopentane	206-016-6	287-92-3	> 1 %	
2-Methylpentane	203-523-4	107-83-5	> 1 %	
Isopentane	201-142-8	78-78-4	> 1 %	
2,3-Dimethylbutane	201-193-6	79-29-8	> 1 %	

REACH Registration number: Not Required

Contains no other components or impurities which will influence the classification of the product.

3.2. Mixtures

See 3.1 above for composition.

SECTION 4: First aid measures**4.1. Description of first aid measures****First Aid General Information:**

Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped.

First Aid Inhalation:

Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped.

First Aid Skin / Eye:

In case of frostbite spray with water for at least 15 minutes. Apply a sterile dressing.

Remove contaminated clothing. Drench affected area with water for at least 15 minutes. Obtain medical assistance. Immediately flush eyes with water for at least 15 minutes.

First Aid Ingestion:

Do not let victim drink anything.

Do NOT induce vomiting.

Get immediate medical advice/attention.

4.2. Most important symptoms and effects, both acute and delayed

In high concentrations may cause asphyxiation. Symptoms may include loss of mobility/consciousness. Victim may not be aware of asphyxiation. In low concentrations may cause narcotic effects. Symptoms may include dizziness, headache, nausea and loss of co-ordination. May have damaging effect on respiratory system, central nervous system (CNS) and liver. Depression of CNS. Symptoms may include dizziness, headache, nausea, unconsciousness, irritation of the mucous membranes and dry coughs. Irregular cardiac activity.

4.3. Indication of any immediate medical attention and special treatment needed

Get immediate medical advice/attention.

SECTION 5: Fire fighting measures**5.1. Extinguishing media****Suitable extinguishing media**

All known extinguishants can be used.

Unsuitable extinguishing media

Do not use a solid water stream.

5.2. Special hazards arising from the substance or Mixture**Specific hazards**

Exposure to fire may cause containers to rupture/explode.

Hazardous combustion products

If involved in a fire the following toxic and/or corrosive fumes may be produced by thermal decomposition:

Carbon dioxide, Carbon monoxide.

5.3. Advice for fire-fighters**Specific methods**

If possible, stop flow of product. Move container away or cool with water from a protected position. If leaking do not extinguish a flame unless absolutely necessary.

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Chemtane Energy LLC

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Spontaneous/explosive re-ignition may occur. Extinguish any other fire. Prevent water used in emergency cases from entering sewers and drainage systems.

Special protective equipment for fire-fighters

Use self-contained breathing apparatus and chemically protective clothing. Clothing for fire-fighters (including helmets, protective boots and gloves) conforming to EN 469 will provide a basic level of protection from chemical incidents. EN 469:2005: Protective clothing for fire-fighters. Performance requirements for protective clothing for firefighting.

SECTION 6: Accidental release measures**6.1. Personal precautions, protective equipment and emergency procedures**

Consider the risk of potentially explosive atmospheres. Evacuate area. Ensure adequate air ventilation. Use self contained breathing apparatus and chemically protective clothing. Eliminate ignition sources. Prevent from entering sewers, basements and workpits, or any place where its accumulation can be dangerous.

6.2. Environmental precautions

Try to stop release.

6.3. Methods and material for containment and cleaning up

Ventilate area. Keep away from ignition sources (including static discharges). Evacuate area. Prevent evaporation by covering with foam. Absorb excess liquid spillage on inorganic adsorbent material such as fine sand, brick dust etc. Place spent adsorbent in sealed packages and contact specialist waste disposal contractor.

6.4. Reference to other sections

See also sections 8 and 13.

SECTION 7: Handling and storage**7.1. Precautions for safe handling**

Only experienced and properly instructed persons should handle the product. The substance must be handled in accordance with good industrial hygiene and safety procedures. Avoid contact with skin. Use only properly specified equipment which is suitable for this product, its supply pressure and temperature. Contact your supplier if in doubt. Take precautionary measures against static discharges. Ensure equipment is adequately earthed. Purge air from system before introducing product. Do not smoke while handling product. Assess the risk of potentially explosive atmosphere and the need for explosion-proof equipment. Consider the use of only non-sparking tools. Ensure the complete system has been (or is regularly) checked for leaks before use. Refer to supplier's handling instructions. Suck back of water into the container must be prevented. Do not allow backfeed into the container. Protect cylinders from physical damage; do not drag, roll, slide or drop. When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders.

Leave valve protection caps in place until the container has been secured against either a wall or bench or placed in a container stand and is ready for use. If user experiences any difficulty operating cylinder valve discontinue use and contact supplier. Never attempt to repair or modify container valves or safety relief devices. Damaged valves should be reported immediately to the supplier. Keep container valve outlets clean and free from contaminants particularly oil and water. Replace valve outlet caps or plugs and container caps where supplied as soon as container is disconnected from equipment. Close container valve after each use and when empty, even if still connected to equipment. Never attempt to transfer products from one cylinder/container to another. Never use direct flame or electrical heating devices to raise the pressure of a container. Do not remove or deface labels provided by the supplier for the identification of the cylinder contents.

7.2. Conditions for safe storage, including any incompatibilities

Observe all regulations and local requirements regarding storage of containers. Segregate from other oxidants in store. Keep container below 35°C in a well ventilated place. Containers should be stored in the vertical position and properly secured to prevent falling over. Stored containers should be periodically checked for general conditions and leakage. Container valve guards or caps should be in place. Store containers in location free from fire risk and away from sources of heat and ignition. Keep away from combustible materials. All electrical equipment in the storage areas should be compatible with the risk of potentially explosive atmosphere. Containers should not be stored in conditions likely to encourage corrosion.

7.3. Specific end use(s)

None.

SECTION 8: Exposure controls/personal protection**8.1. Control parameters****Exposure limit value**

Value type	value	Note
Great Britain - LTEL	600 ppm	EH 40/07

Derived No Effect Levels

Product/ingredient name	Type	Exposure LongTerm	Value mg/kg	Population	Effect
n-pentane	DNEL	Dermal	432	Workers	Sys
	DNEL	Inhalation	3000 mg/m ³	Workers	Sys
	DNEL	Dermal	214	Consumer	Sys
	DNEL	Inhalation	643 mg/m ³	Consumer	Sys
	DNEL	Oral	214	Consumer	Sys

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Predicted No Effect Concentrations
 Not applicable

8.2. Exposure controls**Appropriate engineering controls**

A risk assessment should be conducted and documented in each work area to assess the risks related to the use of the product and to select the PPE that matches the relevant risk. The following recommendations should be considered. Gas detectors should be used when quantities of flammable gases/vapours may be released. Consider work permit system e.g. for maintenance activities. Systems under pressure should be regularly checked for leakages. Provide adequate general or local ventilation. Keep concentrations well below occupational exposure limits.

Personal protective equipment**Eye and face protection**

Protect eyes, face and skin from liquid splashes. Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Wear a face-shield when transfilling and breaking transfer connections. Safety eyewear, goggles or face-shield to EN166 should be used to avoid exposure to liquid splashes. Full-face mask recommended.

Guideline:

CEN: EN136 Respiratory protective devices. Full face masks. Requirements, testing, marking.

Skin protection**Hand protection****Advice:**

Wear cold insulating gloves.

Guideline:

EN 511 Protective gloves against cold.

Chemically resistant gloves complying with EN 374 should be worn at all times when handling chemical products if a risk assessment indicates this is necessary

Material:

Nitrile

Guideline:

EN 374-1/2/3 Protective gloves against chemicals and microorganisms

Body protection

Protect eyes, face and skin from contact with product. Keep suitable chemically resistant protective clothing readily available for emergency use. Personal protective equipment for the body should be selected based on the task being performed and the risks involved.

Guideline:

EN 943: Protective clothing against liquid and gaseous chemicals, aerosols and solid particles.

Other protection

Wear flame resistant/retardant clothing. Take precautionary measures against static discharges. Wear working gloves and

safety shoes when handling cylinders.
 ISO 20345 Safety footwear

Respiratory protection

Keep self contained breathing apparatus readily available for emergency use. Use SCBA in the event of high concentrations. The selection of the Respiratory Protective Device (RPD) must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected RPD. When allowed by a risk assessment Respiratory Protective Equipment (RPE) may be used.

Guideline:

EN 136: Respiratory protective devices. Full face masks. Requirements, testing, marking.

Material:

Filter AX

Guideline:

EN 14387: Respiratory protective devices. Gas filter(s) and combined filter(s). Requirements, testing, marking

Environmental Exposure Controls

Refer to local regulations for restriction of emissions to the atmosphere. See section 13 for specific methods for waste product treatment. Provide adequate general or local ventilation.

SECTION 9: Physical and chemical properties1**9.1. Information on basic physical and chemical properties****General information**

Appearance/Colour: Colourless liquid.

Odour: Faint. Poor warning properties at low concentrations.

Odour threshold:

Odour threshold is subjective and inadequate to warn for over exposure.

Melting point: -135 °C

Boiling point: -42 °C

Flash point: -105 °C

Vapour Pressure 21,1 °C: 8,5299 bar

Relative density, gas: 2,48

Solubility in water: 30 mg/l

Partition coefficient: n-octanol/water: No data available.

Autoignition temperature: 450 °C

Relative density, liquid: 0,5853

Viscosity 0,11 cp at -60 °C

9.2. Other information

Gas/vapour heavier than air. May accumulate in confined spaces, particularly at or below ground level.

SECTION 10: Stability and reactivity

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10.1. Reactivity

Unreactive under normal conditions.

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions

Can form potential explosive atmosphere in air. May react violently with oxidants.

10.4. Conditions to avoid

Keep away from heat/sparks/open flames/hot surfaces. - No smoking.

10.5. Incompatible materials

Air, Oxidiser.

10.6. Hazardous decomposition products

Under normal conditions of storage and use, hazardous decomposition products should not be produced. If involved in a fire the following toxic and/or corrosive fumes may be produced by thermal decomposition:
 Carbon dioxide, Carbon monoxide.

SECTION 11: Toxicological Information**11.1. Information on toxicological effects****Acute oral toxicity**

Value: LD50

Species: Rat

Value in non-standard unit: > 2.000 mg/kg

Slightly toxic.

Acute inhalation toxicity

Value: LC50

Species: Rat

Value in non-standard unit: > 25,3 mg/l

Slightly toxic.

Acute dermal toxicity

Slightly toxic

Acute toxicity other routes

May be fatal if swallowed and enters airways.

Skin irritation

Not classified as an irritant. Repeated exposure may cause skin dryness or cracking. May cause dermatitis by skin contact.

Eye irritation

Not classified as an irritant. May cause mild, short-term discomfort to eyes.

Sensitization

This substance is not classified as a sensitiser.

Repeated dose toxicity

Not expected to cause damage to organs from prolonged or repeated exposure.

Assessment mutagenicity

There is no evidence of mutagenic potential.

Assessment carcinogenicity

No evidence of carcinogenic effects.

Assessment toxicity to reproduction

No indication of toxic effects.

Assessment teratogenicity

No indication of teratogenic effects.

SECTION 12: Ecological information**12.1. Toxicity**

May cause long-term adverse effects in the aquatic environment.

Acute and prolonged toxicity fishSpecies: Rainbow trout (*Oncorhynchus mykiss*)

Exposure time: 96 h

Value type: LC50

Value in standard unit mg/l: 4,26 mg/l

Acute toxicity aquatic invertebratesSpecies: *Daphnia magna*

Exposure time: 48 h

Value type: EC50

Value in standard unit mg/l: 2,7 mg/l

Toxicity aquatic plants

Species: Algae

Exposure time: 72 h

Value type: NOEC

Value in standard unit mg/l: 7,51 mg/l

Species: Algae

Exposure time: 72 h

Value type: EC50

Value in standard unit mg/l: 10,7 mg/l

12.2. Persistence and degradability**Atmospheric degradation**

The substance degrades rapidly in the atmosphere.

Readily biodegradable

Photo degradation

Half life (direct photolysis): 2,3 d

Non-significant photolysis.

Stability in water

Degradation: 71,4%

Duration: 28 days

Non-significant hydrolysis

12.3. Bioaccumulative potential

Not determined

12.4. Mobility in soil

Because of its high volatility, the product is unlikely to cause ground or water pollution.

12.5. Results of PBT and vPvB assessment

Not classified as PBT or vPvB.

12.6. Other adverse effects

None

SECTION 13: Disposal considerations**13.1. Waste treatment methods**

Do not discharge into areas where there is a risk of forming an explosive mixture with air. Waste product should be flared through a suitable burner with flash back arrestor. Toxic and corrosive gases formed during combustion

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should be scrubbed before discharge to atmosphere. Do not discharge into any place where its accumulation could be dangerous. Contact supplier if guidance is required. Dispose of container via supplier only.

SECTION 14: Transport information
ADR/RID

14.1. UN number 1075

14.2. UN proper shipping name

LIQUEFIED PETROLEUM GAS (PROPANE)

14.3. Transport hazard class(es)

Class: 3

Classification Code: F1

Labels: 3

Hazard number: 33

Emergency Action Code: 3YE

Tunnel code: (D/E)

14.4. Packing group (Packing Instruction)

14.5. Environmental hazards

Environmentally Hazardous.

14.6. Special precautions for user

None.

IMDG

14.1. UN number 1075

14.2. UN proper shipping name

LIQUEFIED PETROLEUM GAS (PROPANE)

14.3. Transport hazard class(es)

Class: 3

Labels: 3

EmS: F-E,S-D

14.4. Packing group (Packing Instruction)

14.5. Environmental hazards

Environmentally Hazardous

14.6. Special precautions for user

None.

14.7. Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code

Substance name: PENTANE (ALL ISOMERS)

Ship type required: 3

Pollution category: Y

14.1. UN number 1075

14.2. UN proper shipping name

LIQUEFIED PETROLEUM GAS (PROPANE)

IATA

14.1. UN number 1075

14.2. UN proper shipping name

LIQUEFIED PETROLEUM GAS (PROPANE)

14.3. Transport hazard class(es)

Class: 3

Labels: 3

14.4. Packing group (Packing Instruction)

14.5. Environmental hazards

Environmentally Hazardous.

14.6. Special precautions for user

None.

Other transport information

Avoid transport on vehicles where the load space is not separated from the driver's compartment. Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency. Before transporting product containers ensure that they are firmly secured. Ensure that the cylinder valve is closed and not leaking. Ensure that the valve outlet cap nut or plug (where provided) is correctly fitted. Ensure that the valve protection device (where provided) is correctly fitted. Ensure adequate ventilation. Ensure compliance with applicable regulations.

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

Seveso Directive 96/82/EC: Covered.

15.2. Chemical safety assessment

CSA has been carried out

SECTION 16: Other information

Ensure all national/local regulations are observed. Ensure operators understand the flammability hazard. The hazard of asphyxiation is often overlooked and must be stressed during operator training. Before using this product in any new process or experiment, a thorough material compatibility and safety study should be carried out.

Advice

Whilst proper care has been taken in the preparation of this document, no liability for injury or damage resulting from its use can be accepted. Details given in this document are believed to be correct at the time of going to press.

Further information

Note:

When using this document care should be taken, as the decimal sign and its position complies with rules for the structure and drafting of international standards, and is a comma on the line.

As an example 2,000 is two (to three decimal places) and not two thousand, whilst 1.000 is one thousand and not one (to three decimal places).

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