

**Radcorps Fire & Safety Pvt Ltd.**

*"Complete solution for Fire & Safety"*

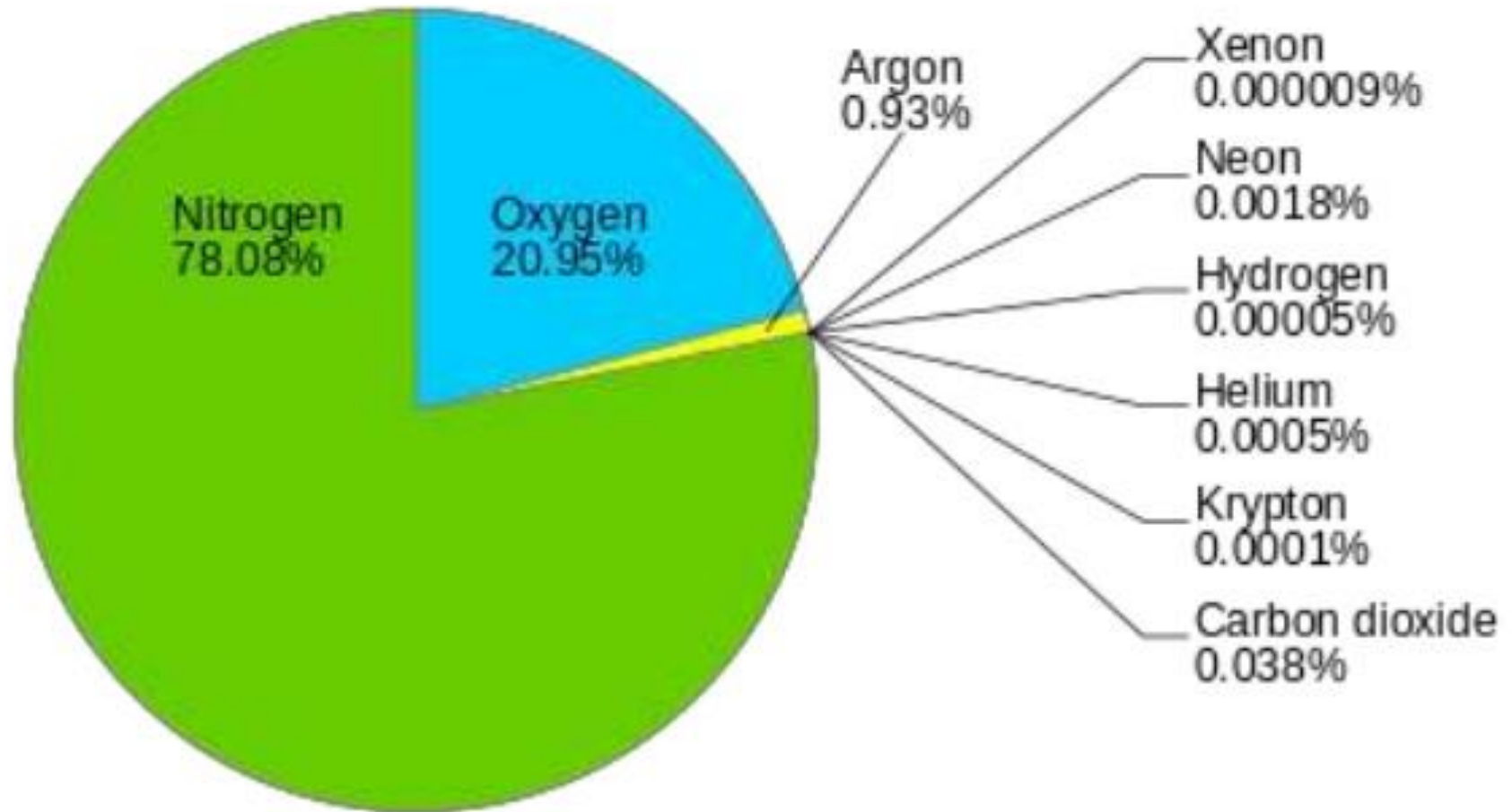
# Breathing Apparatus

- A device that provides breathable air in an atmosphere that poses immediate danger to life and health (IDLH).

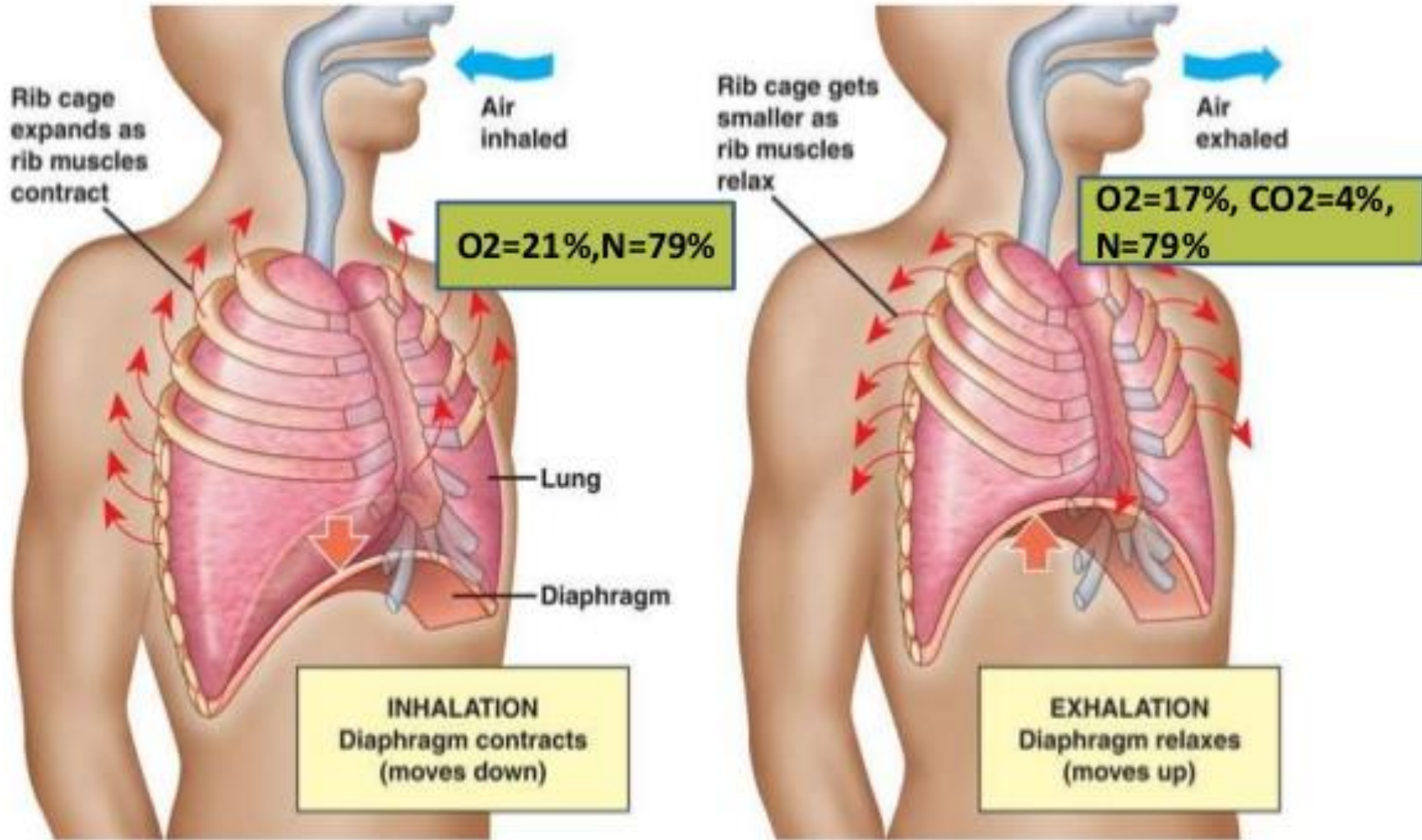
<b>BA</b>	<b>Breathing Apparatus</b>
<b>CABA</b>	<b>Compressed Air Breathing Apparatus</b>
<b>SCBA</b>	<b>Self Contained Breathing Apparatus</b>
<b>SCUBA</b>	<b>Self Contained Underwater BA</b>

# **PHYSIOLOGY OF RESPIRATION**

# Composition of atmospheric air



# RESPIRATORY & CIRCULATORY CYCLES



## HUMAN RESPIRATORY RATES AT REST

- Birth to 6 weeks: 30–60 breaths/minute
- 6 months: 25–40 breaths/minute
- 3 years: 20–30 breaths/minute
- 6 years: 18–25 breaths/minute
- 10 years: 12–15 breaths/minute
- Adults: 16–20 breaths/minute

## BREATHING UNDER VARYING DEGREES OF EXERTION

<i>Degrees of exertion</i>	<i>Number of respirations</i>	<i>Air breathed (lpm)</i>	<i>Oxygen consumed (lpm)</i>
Rest in bed	<b>16.8</b>	<b>7.7</b>	<b>0.237</b>
Rest standing	<b>17.1</b>	<b>10.4</b>	<b>0.328</b>
Walking at 3.2 kmph	<b>14.7</b>	<b>18.6</b>	<b>0.780</b>
Waling at 4.8 kmph	<b>16.2</b>	<b>24.8</b>	<b>1.065</b>
Walking at 6.4 kmph	<b>18.2</b>	<b>37.3</b>	<b>1.595</b>
Walking at 8 Kmph	<b>19.5</b>	<b>60.9</b>	<b>2. 43</b>

# LUNG VOLUME

- a) **TIDAL AIR : 0.5 Ltr** air normally inhaled and the same amount is exhaled at rest.
- b) **INSPIRATORY RESERVE VOLUME: Extra 2 Ltr** of air can be inhaled, by taking a deep breath. ( $0.5+2 = 2.5$  litres.)
- c) **EXPIRATORY RESERVE VOLUME: Extra 1.5 Ltr** air can be expelled out after a normal inhalation and exhalation.
- d) **VITAL CAPACITY** : It is the total exhaled air. ( $0.5+2.0+1.5 = 4$  litres)



## RESPIRATORY HAZARDS

- a) Elevated temperature**
- b) Flash over**
- c) Oxygen deficiency**
- d) Toxic gases**
- e) Smoke, suspended particles, fibres.**

## ELEVATED TEMPERATURE

- a) Damage to respiratory tract; severe if the air is moist
- b) Fluid collection in the lungs leading to breathing difficulty and death
- c) Damaged tissues are not easily reversible
- d) Pneumonia may develop during recovery
- e) Use BA set in atmospheres exceeding 120° F(47° C)

## OXYGEN DEFICIENCY

<b>% OXYGEN IN AIR</b>	<b>SYMPTOMS</b>
21%	NONE, NORMAL CONDITION
17%	SOME IMPAIRMENT OF MUSCULAR COORDINATION; INCREASE IN RESPIRATORY RATE TO COMPENSATE FOR LOWER OXYGEN CONTENT
12%	DIZZINESS; HEADACHE; RAPID FATIGUE
9%	UNCONSCIOUSNESS
6%	DEATH WITHIN A FEW MINUTES FROM RESPIRATORY FAILURE AND CONCURRENT HEART FAILURE

## OXYGEN DEFICIENCY.....

### **TIME IS CRITICAL**



0 to 1 minute: cardiac irritability

0 to 4 minutes: brain damage not likely

4 to 6 minutes: brain damage possible

6 to 10 minutes:  
brain damage very likely

More than 10 minutes:  
irreversible brain damage

## FLASH OVER

- Excessive accumulation of heat from fire
- Intense heat and toxic gases associated with flash over condition require use of BA sets



## TOXIC GASES

- Exposure to irritants and toxicants. (TLV)
- Combined effect of two or more substances is more toxic: somewhat like  $1+1=3$ .

### Toxic gases,

- Eg: – Carbon monoxide, Hydrogen cyanide, Nitrogen oxides, Sulphur oxides... etc..

# Requirements of Wearer

- The wearer must have good Health, good physique and Medically fit. He must have body agility and clear Facial features: Beard, Wound/cuts, bulges.

## DRAGER PSS 3000 & PA90 PLUS

- Self contained
- Open circuit
- Positive pressure
- 2 stages
- Automatic first breath operated.
- Ultra light weight



## PARTS OF SCBA



- Cylinder
- Cylinder valve
- Back plate
- Harness assembly
- High pressure hose
- Low pressure hose
- Pressure gauge
- Pressure reducer
- Warning whistle
- Face piece

## FACEPIECE & LDV



Head & neck harness

Visor

Face seal

Ori-nasal inner mask

Inhalation valve

Exhalation valve

Speech diaphragm

LDV

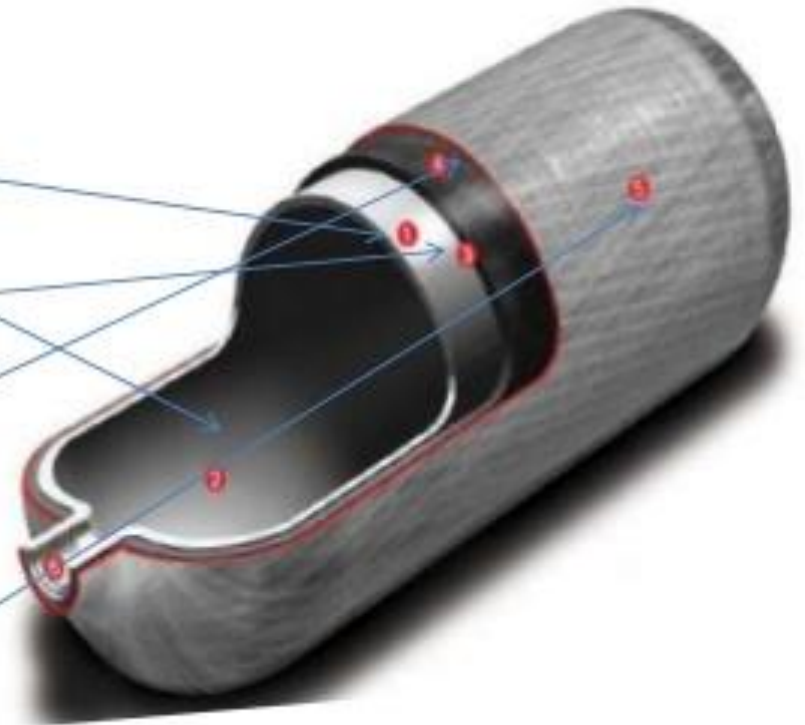


# CYLINDER

## CONSTRUCTION

Aluminium cylinder Fully wrapped with carbon composite  
(*manufactured by Luxfer Gas Cylinders*)

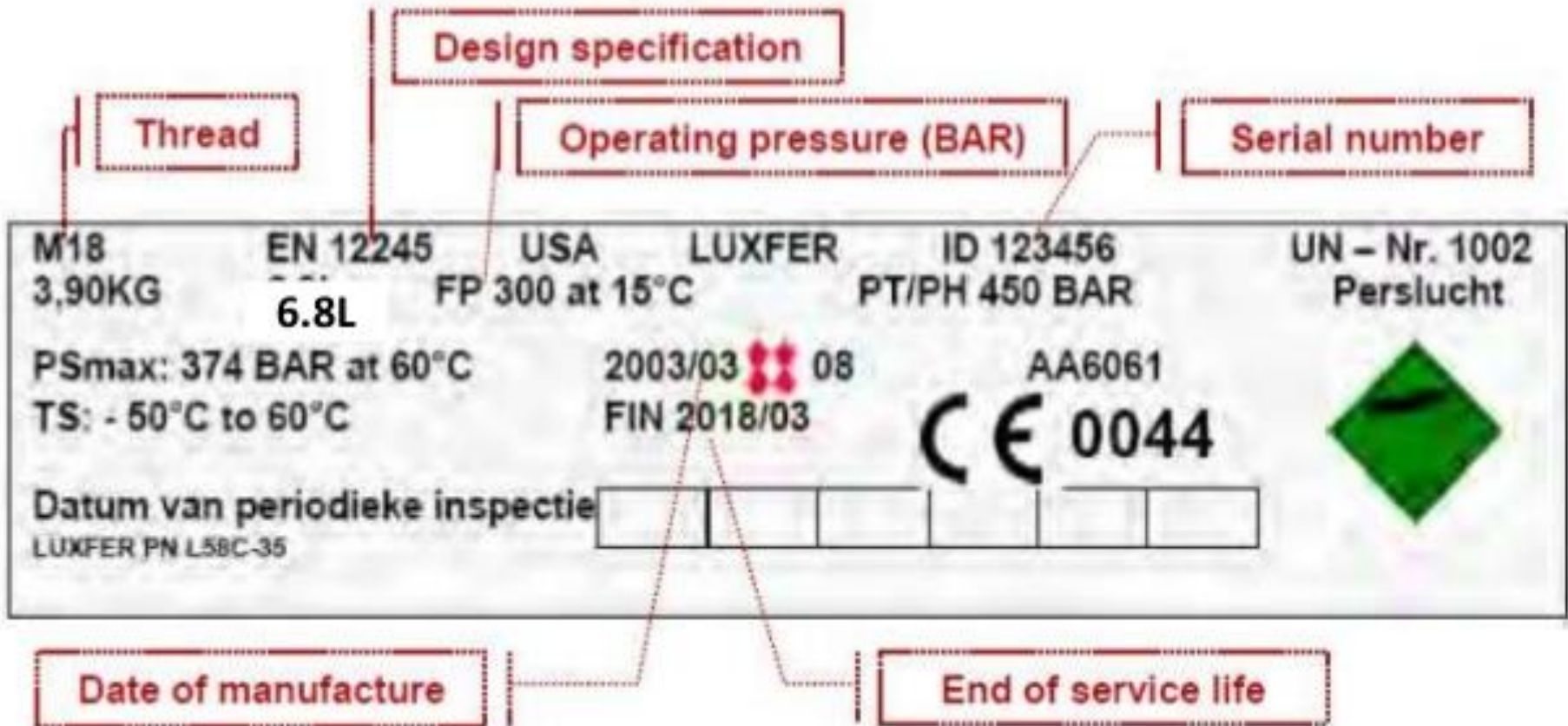
1. Aluminium liner
2. Corrosion resistant internal finish
3. Insulating layer liner and overwrap.
4. Carbon fibre overwrap in epoxy resin matrix
5. FRP protective layer with smooth gel coat



## CYLINDER DETAILS

- Water Capacity 6.8 litres
- Weight 4.2 kg
- Pressure 300 bar /HPT @450 Bar in every 05Years
- Capacity 1840 litres free air
- Full Duration 46 minutes
- Working Duration 36 minutes
- Safety Margin 10 minutes.
- Life: 15 – 30 Years

# LABEL ON CYLINDER



## CYLINDER VALVE & PRESSURE REDUCER

- Valve - protected by rubber buffer
- Hand wheel - fitted with a ratchet
- Cylinder pressure - converted in 2 stages.
- The first stage reducer - 300 bar to approx 7.5 bar
- Second stage reducer (LDV) - 7.5 Bar to Slightly above Normal Atm. Pressure.
- Safety Valve

## PRESSURE GAUGE HOSE

The High pressure hose is tested with:

- Test pressure 450 bar &
- Burst pressure of 800 bar.

The flow restrictor in the reducer (first stage) will restrict the flow to approx 8–9 lpm at 70 bar if any defect occur in the hose.

## LUNG DEMAND VALVE (LDV)

- Fitted on Low Pressure Hose
- Regulates the flow of air into the facemask.
- Satisfies the operator's requirement for air.
- Sustains positive pressure
- **Screw-in connector with swivel feature**
- Detachable
- Quick release male coupling
- Supplementary air supply facility
- Manually operated reset button





## LUNG DEMAND VALVE (LDV) (contd..)

### First breath mechanism

- Actuated by lowering the pressure within the facemask, on inhalation by the operator.
- This allows the set to be switched on without the facemask having to be held onto the face.

### Supplementary air switch

- Located at the centre of the protective rubber cover at the front of the LDV.
- continuous flow of air (nominal 150 lpm) to the mask.

## PRESSURE GAUGE & WHISTLE

### Pressure Gauge

- Constant indication of pressure.
- Stainless steel casing.
- Rubber cover
- Calibrated from zero to 350 bar in 10 bar calibrations.
- Luminous back plate

### Whistle

- When pressure drops to 20% of the fully charged cylinder capacity (50-60 bar).
- consumption - 2 litres of air per minute.

## FACEMASK (DRAGER PANORAMA NOVA)

- Moulded rubber piece
- Reflex seal
- Adjustable head harness made of neoprene
- Full vision visor made of acrylic with 180° vision
- Inner Ori-nasal mask
- Front port assembly with exhalation valve and plug-in port connection



## DURATION OF AIR SUPPLY

- Physical condition of the user
- Degree of physical exertion
- Emotional stability of the user
- Condition of the apparatus
- Cylinder pressure before use
- Amount training and experience with BA

# DURATION (TERMS)

- FULL DURATION : Total volume /40
- SAFETY MARGIN (NORMALLY 10 MIN)
- WORKING DURATION: FD – SM

## CALCULATION OF WORKING DURATION

**Working duration = Volume/Consumption rate - 10**

*(Safety Margin is 10 Minutes)*

$$\mathbf{WD = (V/40) - 10}$$

$$\text{@ 300Bar, } 1840\text{L} \div 40) - 10 = \mathbf{36 \text{ min}}$$

$$\text{@ 200 bar, } = (200/300 \times 1840) \div 40) - 10 = \mathbf{21\text{min}}$$

## POINTS TO REMEMBER WHILE USING BA

- Be in good physical condition
- Check face piece for leaks
- Make sure the set is operating properly before entering hazardous atmosphere
- Work in pairs and stay in oral or visual contact with each other
- Work efficiently to conserve air
- Do not take off face piece if out of breathing air
- Do not take off face piece as soon as the fire is knocked down.
- Take breath and long pause when air is limited in the cylinder when working

# SAFETY PRECAUTIONS

- a) Keep hygiene of the face mask.
- b) Clean the facemask after every use/change of wearers.
- c) Do not connect facemask while wearing which may cause damage
- d) Keep face mask safe from chemicals, dusts, insects..etc
- e) When entering a hazardous area the pressure should be noted down by the concerned supervisor.
- f) Do not keep the cylinder where the heat of fire can directly affect the cylinder.



# **DISTRESS SIGNAL UNIT**

**DRAGER-Bodyguard 1000**

**PASS (Personal Alert Safety System)**

## Bodyguard 1000 -PASS

1. Active LED
2. Low battery LED
3. Left hand button
4. RIGHT Hand Button
5. Manual Alarm Button
6. LED Panel
7. Tally (option)
8. Thermal Sensor



# Features of the DSU

- Simple in use
- Compatible with BA
- High audible and visual alarms
- After 25 seconds without motion and a further 8 seconds without cancellation, the DSU will emit a directional full alarm
- Operating time - 8 hours of alarm (when fully loaded) 2 hours of alarm (after “battery low” alarm)

## AFTER USE

- Do not remove or switch off the unit until safe area of hazards
- Disconnect the unit from the harness strap
- Carry out a functional test
- Clean the unit if necessary
- Store the unit in accordance with the storage instructions

## ENTRAPPED PROCEDURE

- 1. Operate the Distress Signal Unit.**
- 2. Stop all strenuous physical activity and relax in a sitting or lying position.**
- 3. Ensure all members remain conscious and alert and stay in personal contact.**
- 4. Breathe calmly and gently.**

*By following this procedure, the wearer's demands for air will be reduced to approximately 8 litres per minute.*

# DONNING AND DOFFING PROCEDURES

## **DONNING BA**

- 1. COAT METHOD**
- 2. OVER-THE-HEAD METHOD**
- 3. DONNING FROM A SEAT**
- 4. REAR OR COMPARTMENT MOUNT**

# DONNING PROCEDURE

- Check all straps **fully slackened** off.
- Check cylinder valve is **OFF**.
- Check demand valve is **correctly fitted** to the facemask.

## coat method :

- Hold neck-strap, demand valve supply hose and right shoulder strap **in left hand**
- Hold top of strap with **right hand** and swing apparatus around onto the back.
- Place left hand through shoulder strap.



## DONNING PROCEDURE (contd..)

- Fit neck strap, adjust shoulder straps by pulling loops outwards then downwards until set is in a comfortable position.
- Connect and tighten the waist-belt buckle, wrap away excess webbing.
- **Depress the bye-pass switch** off button.
- **Turn on** cylinder valve fully. Listen for leaks.
- Check cylinder contents (minimum 80%).

## START UP PROCEDURE

- Take a deep breath and **fit facemask chin first**, adjust head harness buckles.
- **Exhale breath, then inhale** sharply to initiate first breath mechanism.
- Check your partners head harness is correctly positioned on the head.
- **Insert two finger between your face and the mask.** There should be an out flow of air indicating that the set is operating in positive pressure.

## START UP PROCEDURE (contd..)

- **Take 2 or 3 breaths then hold breath for 5 seconds.** There should be no audible flow.
- **Check supplementary air** operation by pressing the centre switch on LDV. Press Red/black switch to close.
- **Hold breath and turn off** the cylinder. KEEP your hand on the cylinder valve.
- **Observe the gauge for 8 seconds** whilst moving the head through all axis.
- **Breath out slowly observing the gauge** and noting the activation of the whistle.
- **Turn on** cylinder valve and take 2 or 3 breaths.

## START UP PROCEDURE (contd..)

- **Hold breath and again turn off** the air supply to the mask keeping a hand on the cylinder valve.
- **Breathe steadily until the air is finished**, gauge shows empty.
- **Inhale to cause the mask to collapse** on to face.
- Hold breath for 8 seconds ensuring the face mask remains sucked onto the face
- If any leaks re identified, re-fit the face mask and re-test.

## START UP PROCEDURE (contd..)

- Fit anti-flash hood.
- Fit helmet
- Check the gauge reading
- Check DSU as the key with talley is removed at Entry control.

## DOFFING THE BA SET

- Ensure that you are away from the hazard area.
- Take a deep breath and depress reset button on demand valve
- Remove facemask by depressing metal tabs on buckles and slackening head harness.
- Remove apparatus by releasing waist-belt, slackening shoulder straps.

## DOFFING THE BA SET

- Turn off cylinder valve
- Press supplementary air button and bleed air from the system and close on completion.
- Remove cylinder by unscrewing wheel connector.
- Mark cylinder as empty.

# Thankyou



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