SECTION 3

EQUIPMENT

GAS BOTTLES AND QUADS

U.K. AND N. SEA GAS BOTTLE COLOUR CODE

GAS	SYMBOL BODY	CYL/QUAD	CYL/QUAD TOP
HE	He	Brown	Brown
OXY	O^2	Black	White
OXY/HE	O^2/He	Brown	Brown & White Quarters
Nitrogen	N^2	Grey	Black
OXY/He/N^2		Brown	Brown White Black 1/3rd
Argon	Ar	Dark Blue	D.Blue
Air	Air	Grey	Black & White Quarters
Carbon Dioxide	CO^2	Black	Grey
Calibration Gas		Pink	Pink

GENERAL GUIDE TO QUADS

12 TUBE SKID

Capacity	5080 M^3
Dimensions	11.88 m x 1.95 m x 2.5 m
Weight	24 Tons
W.P.	207 BAR or 3000 PSI
Shipping Vol.	56.73 M^3

STANDARD ISO

Capacity	1755 M^3
Dimensions	6 m x 2.5 m x 2.5 m
Weight	20 Tons
W.P.	200 BAR or 2,900 PSI
Shipping Vol.	36.25 M^3

64 CYLINDER QUAD

Capacity	Helium & Mix 585 M^3 Oxy or HP Air 646 M^3
Dimensions	1.88 m x 2.11 m x 2.11 m
Weight	6.2 Ton
W.P.	200 BAR or 2,900 PSI
Shipping Volume	8.37 M^3

16 CYLINDER QUAD

Capacity	Helium & Mix 146.5 M^3
Oxy or HP Air	161.5 M^3
Dimensions	1.04 m x 1.9 m x 1.04 m
Weight	1.6 Ton
W.P.	200 BAR or 2,900 PSI
Shipping Volume	2.07 M^3

12 CYLINDER QUAD

Capacity	Helium & Mix 90 M^3
Oxy or HP Air	98 M^3
Dimensions	1 m x 1.8 m x 1 m
Weight	1.2 Ton
W.P.	175 BAR or 2,500 PSI
Shipping Volume	1.63 M^3

USUAL THREADS ON VALVES

He & Mix	Loose Cylinder 0.86" 14 TPI R.H. Witworth Male
	16 Cyl. 0.86" 14 TPI R.H. Witworth Male
	12 Cyl. 0.86" 14 TPI R.H. Witworth Male
	64 Cyl. 1/2" N.P.T. R.H. Female
Oxy/Air	Losse Cylinder 5/8" BSP R.H. Female
N^2/Air	12 Cyl 5/8" BSP R.H. female
	16 Cyl 5/8" BSP R.H. female
	64 Cyl 5/8" BSP R.H. Female

THREAD ABBREVIATIONS

B.S.P.	British Standard Parallel Pipe Thread
B.S.T.P.	British Standard Tapered Pipe Thread
J.I.C.	Joint Industrial Council
MM	Metric
NPT	National Pipe Thread
SAE	Society of Automotive Engineers
UNC	Unified Course
UNF	Unified Fine
W	Witworth

DDC CHARACTERISTICS

TYPE	mm	length mm / longueur	width mm / largeur	height mm / hauteur	Volume (m^3) chamber / caisson	Volume (m^3) lock / sas	weight tons / poids
1 200	1 200	3 525	1 440	1 500	2,46	1,26	2
1 500	1 500	4 200	1 600	1 900	4,2	2,1	4
1 800	1 800	5 210	2 100	2 590	7,7	3,6	8
2 000	2 000	2 300		2 700	7,26		10
2 100/4	2 100	5 700	2 300	2 400	12,3	5,4	15,4
2 100/6	2 100	7 100	2 300	2 400	16	5,4	18
2 300	2 300	4 200	2 400	2 715	13,75		11
2 500	2 500	7 950	2 580	3 300	33		18

DIESEL ENGINE CONSUMPTION

A diesel will use .4 pints or .23 Litres per hour per B.H.P.

1 HORSE POWER = 550 LB. PER SEC.

WATER JETTING NOZZLES

There are two main types - a pin jet and a fan jet.

A Pin Jet concentrates a H.P. stream usually used for cutting concrete or removing difficult material.

A Fan Jet covers a wider area and is used for coatings, marine growth, or softer material.

The main characteristics of an efficient nozzle are:

- A conical section to diminish turbulence
- A plain section to straighten the jet
- A sharp edge to allow the jet to break away cleanly.

When using a nozzle selection chart, be sure to take into account the flow rate and pressure of the pump. Select the correct size pin nozzle. For the same flow and press, a fan jet must be 10% larger.

Nozzles are usually made from stainless steel or tungsten carbide. For underwater, use with retro jet. Select nozzle by looking up half the flow available.

ANODES

Made from Zinc, Magnesium, Aluminum, and Lead in general.

BAUER H.P. COMPRESSORS

Lubrication preferably TALPA 30 or ORDINA 68

One can use,

86 °F	30 °C plus	SAE 30
32 °F - 86 °F	0 °C - 30 °C	SAE 20
32 °F - 5 °F	0 °C - 30 °C	SAE 5
Below		

Oil change every 250 hours
Filters every 25 hours

CORBLIN GAS TRANSFER & ROOTS REGENERATION

Lubrication LOBELLA FM 68

QUINCY LP COMPRESSOR

Lubrication TALPA 30 or T100 TURBO OIL
Oil Change every 250 hours
Clean Filters every 25 hrs.

EXPLOSIVES UNDERWATER

General Tips

1) Always use det. or cap of 6-8 power. Never remove shunt until firing.
2) Primacord or Detcord burns at 2100ft/p. sec., 640.48m/p. sec. plastic coated.
3) Waterproof ends of cord with black bostick.
4) Misfire wait 30 min. check Det or Primacord
5) Rigging the charge and cord avoid sharp angles.
6) Always keep back some explosive in case of misfire.
7) Electrical lead circuit tester is call a Galvanometer.
8) In general elect, black twin core should be 51 OHMS resistance per 1000 yards.
9) For firing use a fully charged battery or main leads.
10) When cutting conductor piles place two ring shaped charges 2 m apart with two vertical charges between them. This should split casing and crumble cement in next.
11) In sand, cement, clay, use a low explosive for pushing effect.
12) Drilling holes in rock use a pneumatic wagon drill not a jackhammer.
13) After placing charge in hole, plug it.
14) Datesheet make up is PETN plus an elestromeric binder comes in sheets colour drab olive green usually. It is easy to mold. Recommended adhesive Du Pont 4684.

ELECTRICAL

CABLE

1mm Short line 15 amp. do not use for circuit bigger than 10 amp fuse.

1.5mm As above but use for longer lines.

2.5mm Up to 20 amp. or if used in a ring main 30 amp.

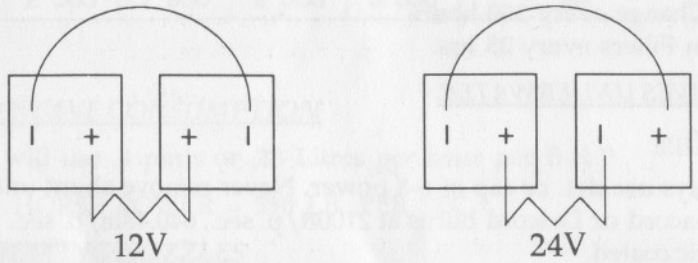
4mm Up to 35 amp.

6mm Up to 45-50 amp.

Long running wire - rule of thumb go up one size.
Short run would be anything up to 15m.

WATTS	=	Usage or work
AMPS	=	Flow
VOLTS	=	Pushing force

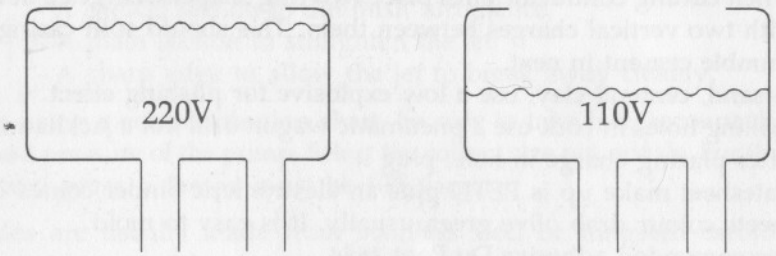
$\frac{W}{V|A} = A \frac{W}{V}$ $W = A \times V$ $V = \frac{W}{A}$



Inside DDC's and Bells, the maximum voltage allowable is 24V.

AN EXPLANATION OF ELECTRICITY

To explain electricity simply we will use water, water tanks and pipes and change the terminology a little.



If we consider voltage the supply or volume of water, amperage the pressure needed to push the water down the pipes, and OHMS the resistance in the pipes to the flow of water.

Obviously to get 220V down the pipes is going to require a lot less pressure than 110V. Likewise a large pipe will have less resistance to the flow and need less pressure to get it along the pipe, than a small pipe.

Do not forget Wattage = Energy consumed. (Nobody knows yet how much wattage is used to drink a beer).

The most important thing to remember about electricity is that although it can not be seen it bites. High voltage can stop the heart, coupled with high current it can cause awful burns. (see Electrical Shock Part 2).

Also beware of small batteries wired together. Some of these will give off enough amperage to heat up metal if shorted (ie. a wedding ring), and it is possible you could lose a finger.

It is advisable to have respect for wiring around the bell. (And even the D.D.C. if high voltage scrubbers are used). As much of the lighting, battery charger, etc. on the external side of the bell is supplied by 120V A.C.

When this is so the circuit breaker must be fitted with a Class 'A' earth leakage detector to protect the diver. (o.5 m amp. to 30 milli amp.)

We have already had a look at the watts, amps, volts formula. Now let us look at OHMS Law. OHMS Law takes into account resistance. (It is the same principle as hydraulics, ie. small pipe, low flow, high resistance.large pipe, large flow, low resistance.)

A high voltage of 120V is often used on external bell equipment, because the voltage drop due to the resistance in the umbilical is unacceptable to say 24 volts. It is also the reason battery chargers are placed on bells fed by 120V AC, they supply the bell internally with 24V DC. Using OHMS Law which is -

V = AMPS X RESISTANCE

$V = A \times R$ $A = \frac{V}{R}$ $R = \frac{V}{A}$

ie. Assuming that a bell umbilical has a resistance of 6 OHMS (3 down, 3 back) also assuming that on the bell, batteries, lights, scrubber and heater motors consume 4 amps at 24 volts. If this is fed from the surface a 4 amp D.C. supply would have to be 24 Vplus the voltage lost through the cable which would be:

V = A x R = 4 amp. x 6 ohms = 24V lost in cable + 24 volts required = 48 volts DC supply would have to be maintained at the surface.

Alternatively, if I supplied umbilical with 120V which is 5 x 24V, only 1/5 of the current or amperage would be required. Using OHMS Law

$$\frac{4 \text{ amps}}{5} = .8 \text{ amp.}$$

V = amps x resistance = .8 amp x 6 ohms = 4.8 volts lost in bell umbilical cable. Wattage is energy consumed.

ie.	24V	x	4 amps	=	96 watts
	120V	x	.8 amps	=	96 watts

MARSH-MARINE CONNECTORS are designed to squeeze closed as the water pressure reacts upon the connector evenly. I often see divers putting electrical tape around the connector. This deforms the connector so the water pressure does not act evenly and the connector leaks.

Batteries should not be taped together with silver duct tape which conducts and discharges batteries.

BELL SONAR

Works at 37.5 kilohertz.

FILTERS AND COMPOSITION

Filters come in three main forms. Absorbant, Adsorbant, Catalyst.

Absorbant — Soda-Line, Calcium, Chloride, Barium, Hydroxide, Baralyme, Lithium Hydroxide.
For Elimination of: Nitrogen Dioxide, Carbon Dioxide, Nitric Oxide, Tricoethelene, Ethy Mercaptans, Frury Mercaptans, Hydrogen Sulphide.

Adsorbants — Silica Gel, activated Alumina, Purafil, activated charcoal, marbles.
For elimination of: Water Vapours, Odours, Diesel Fumes, Chlorine.

Catalyst — HOPCALITE - Copper Oxide, Cobalt, Silver Oxides
To change Carbon Monoxide to CO^2.

MOLECULAR SIEVE MATERIALS = Synthetic crystaline zeolites ie. cavities joined by window, can occupy 50% of volume of crystal for Dynamic gas drying, and selective absorption of chemicals.

SCREEN FILTERS — Wooven wire.

DEPTH FILTERS — Compressed fibres, sintered metals
To remove solid particles.

Welding

Welding Data

Mild Steel thickness			Nozzle size	Operating pressure				Gas consumption			
				Acetylene		Oxygen		Acetylene		Oxygen	
mm	in	swg		bar	lbf/in²	bar	lbf/in²	l/h	ft³/h	l/h	ft³/h
0.9	--	20	1	0.14	2	0.14	2	28	1	28	1
1.2	--	18	2	0.14	2	0.14	2	57	1	57	2
2	--	14	3	0.14	2	0.14	2	86	3	86	3
2.6	--	12	5	0.14	2	0.14	2	140	5	140	5
3.2	1/8	10	7	0.14	2	0.14	2	200	7	200	7
4	3/32	8	10	0.21	3	0.21	3	280	10	280	10
5	3/16	6	13	0.28	4	0.28	4	370	13	370	13
6.5	1/4	3	18	0.28	4	0.28	4	520	18	520	18
8.2	5/16	0	25	0.42	6	0.42	6	710	25	710	25
10	3/8	4/0	35	0.63	9	0.63	9	1000	35	1000	35
13	1/2	7/0	45	0.35	5	0.35	5	1300	45	1300	45
25+	1+	--	90	0.63	9	0.63	9	2500	90	2500	90

Size 45 and 90 require HD Mixer

Cutting

Cutting Data
Saffire A-NM Acetylene Nozzles

Plate Tk'ness		Nozzle	Operating pressure				Gas Consumption					
			Oxygen		Fuel		Cutting Oxygen		Heating Oxygen		Fuel	
mm	in	size	bar	lbf/in²	bar	lbf/in²	l/h	ft³/h	l/h	ft³/h	l/h	ft³/h
6	1/4	1/32	1.8	25	0.14	2	800	28	480	15	400	14
13	1/2	3/64	2.1	30	0.21	3	1900	67	570	20	510	18
25	1	1/16	2.8	40	0.14	2	4000	140	540	19	470	17
50	2	1/16	3.2/3.5	45/50	0.14	2	4500	160	620	22	560	19
75	3	1/16	3.5/4.2	50/60	0.14	2	4800	170	680	24	620	22
100	4	5/64	3.2/4.8	45/70	0.14	2	6800	240	850	30	790	27
150	6	3/32	3.2/5.5	45/80	0.21	3	9400	330	960	34	850	30
200	8	1/8	4.2	60	0.28	4	14800	510	1380	48	1250	44
250	10	1/8	5.3	75	0.28	4	21500	760	1560	55	1420	50
300	12	1/8	6.3	90	0.28	4	25000	880	1560	55	1420	50
Sheet		Asnm	1.5	20	0.14	2	800	206	85	3	85	3

When using Type 3 cutting attachments, the higher oxygen pressures should be used up to the maximum cutting capacity of 150mm (8")

ACETYLENE OVER 15 P.S.I. IS INFLAMMABLE.

UNDERWATER WELDING

1) Straight Polarity D.C.
2) 3/16 Rods are best.
3) Splits and holes use a patch.
4) Drill holes in end of splits.
5) Upside-down patch use a magnet.
6) Use 200-300 amps or set up for topside welding and increase by 20 - 30 amps.
7) Weld dropping = too much heat
   Weld Sticking = not enough heat.

UNDERWATER CUTTING

1) Use DC wherever possible. If you have to use A.C., insulate everything, including divers helmet.
2) Check welding machine is grounded. And check ground to job. If possible, consider an extra ground cable in rig.
3) Check amps to be used with rods.
4) Use straight polarity - negative pole.

PHOTO TECH EQUIPMENT

METHOD 1

E6 transparency, direct positive print to cibachrome paper. Result is a negative print pos. to pos. Now with the help of a machine called Clentar, mass prints are possible.

METHOD 2

Negative film C41 onto E2 paper. Result is print taken off a negative normal neg. to pos. Mass production is much more difficult using this method.

METHOD 3

Stereo photos use transparency or negative film 70 mm.

DIVERS GUIDE TO FILM PRINTING

1) Prepare and fill developing trays and place in order of use towards a water supply ie. developer, stop bath, fixer, washing unit.
Lights out - only red safety light.

2) Place easel under enlarger, with distance arms to correct size of print to be used.

3) Switch on enlarger, move up and down to get correct image, size, and focus. This is to be done at the lowest F stop for enlarger so as to have a bright image to focus on.

4) Reduce to a middle F stop it will always look too dull.

5) To make a test strip remove one print from box. After removing print replace box lid.

6) Have a piece of cardboard of a greater size than the print and cover 3/4 of print.

7) Have stop watch ready, switch on light, at 4 sec. elapsed time move cardboard to 1/2 way, at 6 sec. move cover to 3/4 point. At 8 sec. remove cover from print. At 10 sec. switch off light.

8) What we have done in effect is the last 1/4 had 2 sec. The next 4 sec., the next 6 sec., the next 8 and the last 10 sec.

9) Place this into the developing tank, rocking tray slowly so that the developing chemical washes surface of print.

10) When fully developed (roughly 2 min.) pick up with tongs and place into stop bath tray. After 20 sec. pick up and drain and place into fixing tray leave for 4 min. After this place in a bucket of fresh water and wash.

11) The developing print will have the image in strip form across the print in various intensities. Check the one that has the correct development (interpolate if need be) as a rough guide. This time can be used for the film strip you have developed at the 'F' stop used to make the film test strip.

12) If you are finished and prints have a burnt edge, you are switching the white dark room light on too soon before the print is fully developed.

If the print is not developed properly, your developer either needs an additive to restore it to full strength (see mixing instruction on packet) or a new mix is required).

REMEMBER for successful developing and printing:

A) Chemicals need to be exact recommended proportions
B) No stages to be skipped.
C) Darkroom not to be visited.
D) Darkroom and operator kept to a high standard of cleanliness.

DIVERS GUIDE TO FILM DEVELOPING

1) Light. When unloading film from camera, as soon as rewind is slack stop, so cassette has tail of film protruding.

2) Prepare developing tank ie. tank with top off, scissors and developing spool in position, you should be able to find it all in the dark.

3) Dark. Pull tail of film clear of spool, cut thin part off with scissors. If the film is completely inside cassette,remove either end of cassette, this comes off easily (take care not to handle the emulsion on the film) so hold film on either edge.

4) Feed film into the start of the developing spool until both perforated sides of film are engaged in ball bearings. Slowly rotate spool backwards and forwards until all of film is wound onto spool. (if you have not done this before, practice with an old film in the light).

5) Place spool in developing tank and put lid on.

6) Switch on lights.

7) Light on, make up film developer as per instructions. check that the mix to water is the right ration and also, very important, at the right temperature.

8) Make up the stop bath with points to note as for (7).

9) Make up fixer with same regard.

10) Check on printed sheet supplied with each film for the correct developing time. As a norm develop for 7 min. Pour developer into developing tank. Rotate developing tank to ensure no air bubbles stick to film.

11) Start stop watch.

12) At the end of developing period, pour developer back into container to be re-used.

13) Pour in stop-bath for 30 seconds rotating tank as before. Return liquid to container.

14) Pour in fixer for 7 minutes rotating tank as before. Return liquid to container.

15) Place developing tank under cool tap water and let run for 40 minutes to wash film.

REMEMBER:

A) You develop the film.
B) You stop the developing agent.
C) You fix the developed image into the negative.

AIR PURIFICATION KIT

DRAGER TUBES NEEDED

3x (CO^2) Carbon Monoxide Tubes No. CH 19701/8-159 PPM.
3x (CO^2) Tubes CH 30801/0-01 to 0.3 PPM.
3x Hydrocarbons CH 25401 2/35 milligrams per litre.
3x Water Vapour CH 23401 Oil Mist Tubes.

BREATHING GAS PURITES STANDARDS

Breathing gases should be blended from pure gases and the mixing process should not add any impurities at concentrations likely to cause toxic or other harmful effects when breathed continuously under pressure.

OXYGEN	99.5%	
MAXIUMUM PERMISSIBLE CONTAMINANTS:	Nitrogen	0.1%
	Argon	0.4
	Hydrocarbons	3ppm
	Methane	25ppm
	Carbon Diozide	5ppm
	Carbon Monoxide	1ppm
	Moisture (H2O)	25ppm
HELIUM	9.97%	
MAXIMUM PERMISSIBLE CONTAMINANTS:	Nitrogen	200ppm
	Oxygen	50ppm
	Neon Hydrogen & Argon	25ppm
	Hydrocarbons	1ppm
	Carbon Dioxide	1ppm
	Carbon Monoxide	1ppm
	Moisture	25ppm
NITROGEN	99.9%	
MAXIMUM PERMISSIBLE CONTAMINANTS:	Oxygen	50ppm
	Hydrocarbons	1ppm
	Carbon Dioxide	1ppm
	Carbon Monoxide	1ppm
	Moisture	25ppm

Oil mist should not be present. However, if detected after pumping the level of contaminant should not exceed 1 mg/m^3.

HASKELL REPAIR KIT RECOMMENDED

2 Complete Repair Kits for AGD 4 Pump
2 Complete Repair Kits for AGE 15 Pump
2 Complete Repair Kits for AGD 30 Pump
4 Mufflers
1 MARSH 5000 psi 2.5" Dual size, Bottom Mount 1/4 NPT Gauge
1 Circle Clip 5.0 Micron Filter No 4425G 5TC
1 Air Regulator C.W. Guage R-100-8-G
1 Special Tool Kit for Air Drive Repair No 28584
2 software Kit for Jamesbury Ball Valves

REPAIRS KITS

AGD 4 PUMP

26267	Gas Section Seal Kit
16771	Air Control VV Seals Kit
17327	Distance Piece
16772	Air Drive Seals Kit
27240	Inlet Check VV Assembly
27241	Outlet Check VV Assembly

AGD 15

17676-15	Gas Piston Seals Kit
17677-15	Check VV Seals Kit
16771	Air Control VV Seals Kit
17327	Distance Piece
16772	Air Drive Seals Kit
17842-15	Gas End Cap Assembly

AGD 30

17676-30	Gas Piston Seals Kit
17677-30	Check VV Seals Kit
17329	Air Control VV Seals Kit
17326-30	Air Drive Seals Kit
17842-30	Gas End Cap Assembly

DENSITY OF THE COMMON METALS

$$\text{DENSITY} = \frac{\text{MASS}}{\text{VOLUME}}$$

METAL	LBS/0.0283 M^3 / LBS/1 FT^3
ALUMINUM	167
BRASS	510 - 540
BRONZE	537
CAST IRON	450
COPPER	550
LEAD	709
STEEL	435 - 493
NICKEL	540
TIN	455
ZINC	428

A GUIDE TO BELL INTERNAL AND EXTERNAL CHECKS

All Bells differ and checks differ with different equipment.
This is a guide.

BELL INTERNAL

Lights — Internal - on
External - flash only

Power — Main Scrubber
Heater
Emergency Power and Light

Comms — Surface to Bell/Bellman
Diver 1 + 2
Genphone
Emergency through water

Weight Release — Check weight release handles and pins are in place and free to move. If relative pins are marked primary and secondary release.

Valves

Blowdown/Exhaust to Surface	Open
Divers Blowdown	Closed
Divers Exhaust	Closed
Cluge Divers 1 - 2	Open
Side & Bottom Door Equalization	Closed
Emergency	Open
Analysis	Open
Hot Water to Diver 1 - 2	Closed
H.W. Bypass	Open
H.W. Dump	Open
H.W. In	Open
Bottom Door Hydraulics	Open
Divers Gas from Surface	Open
Bellmans/Divers gas from Bell Bottles	Open

Check surface and bell gas to divers hats through reducers then leaving main surface supply on line, close down steam valves (below reducers) and bleed off hats.

TESTING A COMEX FAILSAFE IF FITTED

Open gas to regulator, set 8-10 bars, open downstream VVs and check gas to hats and Bibs using each regulator independently Close main umbilical gas supply, bleed off hats and secondary blowndown and watch gas switch over to H.P. onboard gas supply.

Closed secondary blowdown and re-open main umbilical supply and watch supply return to surface supply. Have surface adust pressure as necessary 50 BAR is normal. Leave manifold on main supply, downstream VVs closed and hats bled off.

Bell Internal & External Pressure	Open
Oxy In Closed	
Oxy Pilotage to Reducer	Open
Bell Internal Flood Valves (Diver Rescue)	
Top	Open
Bottom	Closed
Fine Bleed/Venturi Drain if fitted	Closed
Bailout Bottle Charging off Bell Bottles	Closed

BELL EQUIPMENT

Portable Oxy Analyser
First Aid Kit with Ridgid Collar and Godel Tube
Emergency Respirators with Fresh Sodasorbe
Drager Pump and Tubes with Correct Scaled Tubes
Spare Soda sorb and Drinking Water
Spare 'O' Rinds for Doors/Bailout Bottles
Survival Packs or Aluminum Blanket
Emergency Tapping Code
Fenzy, Charged, with attached Pencil and Slate
Half Mask
3 Divers Knives
2 Flashlights with spare batteries and bulbs
Note: Do not wrap batteries in silver duct tape it is an electrical conductor.
Diver Harness
Bellman Harness
Work Gloves
Fins & Spare Straps
Bailout Bottle and Whip & 1st Stage
Silicone Grease
Spare KMB if one available
Plastic Garbage Bags
Divers Compass
Diver Recovery/Pully with Locking Device
Shampoo or other Demister
Contents Guage
Weight Belts and Weights

TOOL KIT

Hacksaw and spare blades
Hammer
Pliers
Spike
12" & 8" Adjustable
Tape - electrical, teflon, silver duct
Screwdriver - blade and phillips head

Note:

Consider having or fabricating a bell port blowout seal.

BELL EXTERNAL CHECKS

Open all onboard gas and note pressures. All valves should be fully open and one quarter turn back.

CHECK THE FOLLOWING IN PLACE AND SECURE:

Bell strobe, through water coms transponder, bell sonar, portable hydraulic cable cutter, lifting pin and swivel is greased and nothing loose, secondary lifting bridle or shackles. Swimlines, rope and tools necessary for job. Always check with Supervisor as to what rigging is supposed to be carried.

Primary and Secondary method of dropping weight are secure. No visible damage to umbilical and sock. Portholes are clean. Emergency battery pack secure and charging connection released if necessary. Emergency tapping code in place.

Lights

Externalflash only
Strobe working

Valves

Work all valves and leave in correct mode.

Blowdown/exhaust to surface	Open
Divers Exhaust	Open
Cluge divers 1 - 2	Open
Outside door equalization	Check with supervisor
Emergency	Closed
Analysis	Open
Hot water in	Open
Hot water dump	Open
Bottom door hydraulics	In correct mode to, if necessary, operate.
Divers gas from surface	Open
Onboard gas supply	Open
Bell Internal & External Press	Open

Oxy in	Open
Oxy pilotage to reducer	Open
Bell flooding	Open

Remember, these lists are a guide, checks may change ie. gas reclaim could be used. In general, it is normal for the diver doing outside bell checks to sign for his checks and report to the Supervisor.

EMERGENCY PROCEUDRES - GUIDE

Some tips if you are stuck in a Bell waiting for rescue.

You should have followed your emergency procedures. Ditching of the weights is only done as a very last resort should help not arrive and death seem imminent.

Keep calm. Take off all wet things and get into your survival bag or aluminum blanket with whatever warm/dry clothing you have, towels, etc. immediately wear your CO^2 re-breather and take this into your suit or blanket with you. Leaving only the exhaust end protruding. The action of breathing through sodasorb will create some heating of the gas inhaled.

Monitor your oxy make up, all bell divers should be fluent with this procedure.

Monitor your CO^2 level, and renew sodasorb when necessary. All Bell divers should be fully familiar with how to monitor, and know exactly, the CO^2 level, almost instantly the reading is taken.

Use emergency light and torches as little as possible.

Remember this is a guide. Company Policy or the job Superintendent instructions should normally be followed.

EMERGENCY PROCEDURES

Loss of Gas to Diver

Diver. No gas to the diver, diver goes immediately to bailout, simultaneously informing surface NO GAS, and returns to bell. Upon arrival in the bell, and if the cause cannot be found and rectified, the dive shall be aborted.

Bellman. Sould switch immediately onboard gas, (FAILSAFE PROBABLY HAS ALREADY DONE SO) inform surface to bring back diver to bell. If lost comms give four (4) pulls and haul diver back. Be ready for diver recovery.

Powerloss to Bell

Abort dive, diver returns to bell, go on B.I.B.S., switch on emergency light only, NOT SCRUBBER.

If power cannot be resumed, switch on emergency scrubber and prepar to surface. IF NECESSARY, FOLLOW LOSS OF COMMUNICATIONS PROCEDURE.

Complete Communication Loss to Bell

Diving Supervisor will:

- Establish through water comms and abort dive.
- If this fails, Supervisor will await the following:

Diver

- Diver upon realising that communications have been lost returns immediately to the bell. After establishing total loss of communications, diver will release a NUCALON float or Fenzy up the guide wire before finally entering the bell.

- Diver enters the bell, gets a seal and prepares to surface. Signal surface on main BLOWDOWN valve.

FOUR 4 BURST READY TO SURFACE

Surface

- After seeing the float or pressure drop, or either signal, wait 15 minutes then lift Bell 10 metres and check pressure.

- Continue to recover bell if pressure indicate a seal until bell in range of surface diver, at which time jump the standby diver.

MAIN LIFT CABLE BREAKS

If Bell is at atmospheric pressure, wait. (See "Tips if you are stuck in a Bell".) If after a period when it is obvious you must do something or die, (your survival resources are nearly exhausted) pressure bell using bell banks and follow "Work to be done outside Bell".

WORK TO BE DONE OUTSIDE BELL

Dive exits and using portapack hydraulic cutter cuts all debris off bell. If system is so designed release primary weight release (usually chains). Before entering bell release float or fenzy with message. Obviously if bell was already pressurized prior to accident, work outside bell would be your priority.

Continue to wait for rescue, keep warm, ration your resources. Only when it seems obvious no rescue attempt is forthcoming close all internal hull valves. Secure everything, strap yourselves into seats, and using secondary release drop bell weights.

Usually the bell can be located using sonar, the through water coms. etc. And recovery of bell done using the main umbilical, (if still intact) guide wire system or both. The main thing is try to stay calm, think. But more important know how to monitor your environment and yourselves before you enter the bell. Always discuss procedures with your supervisor.