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**OPERATING & MAINTENANCE GUIDE
HOISTING HEAVY STRUCTURE 1,000 ~
10,000 Tons**

for

***INDUSTRIAL/ MARINE INFLATABLE RUBBER
AIR-GASBAG***

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(1) Air-gasbag Structure

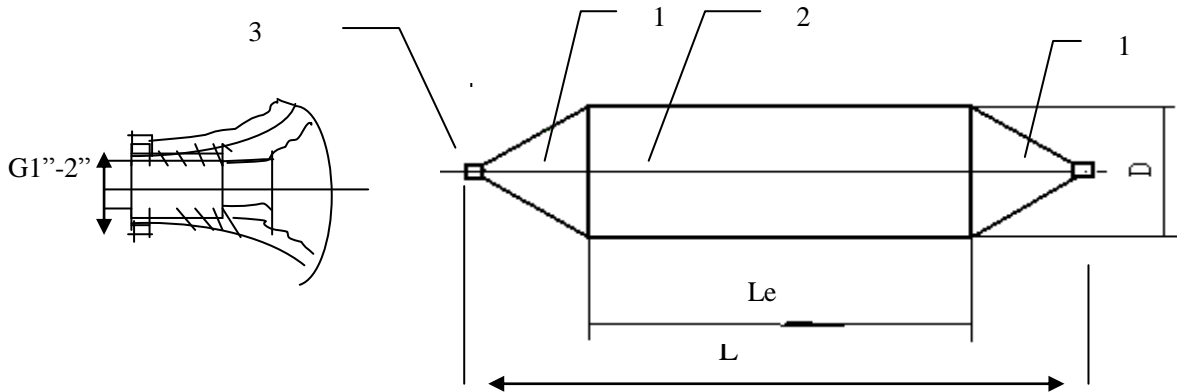


Fig 1.1 Air-gasbag Structure

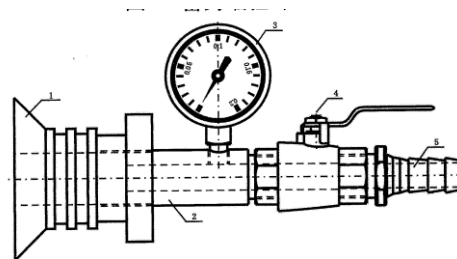


Fig 1.2 Airbag safety air inlet

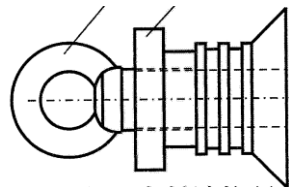


图5 密封端拉环

Fig 1.3 Air tightness swivel

1. Air-gasbag point end
2. Main body
3. Air inlet safety valve G 1''~2''
4. D = Utricle diameter
5. Le = Main body length
6. L = Overall Effective length

- Air-gasbag structure consists of raw rubber material from Malaysia SMR 3 with reinforced nylon for layer by layer. The nylon reinforced nylon segregate $\geq 95/10$ cm in wide and tensile strength ≥ 205.8 N per length.
- Air Inlet safety valve with inner tread types G 1''~2'' depending on the air-gasbag size.
- Method of fabrication: Integrate twine technology with layer by layer.

(2) Air-gasbag specification and feature

Types of Air-gasbag for load carried

<i>Airbag types</i>	<i>Airbag Model</i>	<i>Effectiveness on area contact against load carried (kg/m³)</i>	<i>Ranges of capability hoisting weight</i>	<i>Air insulation / Air tightness within 4 hours</i>	<i>Application</i>
<i>Low pressure Air-gasbag</i>	<i>CL-III ~ CLV</i>	<i>5</i>	<i><1,000 tons</i>	<i>< 5%</i>	<i>Buoyancy for sunken ship; small vessel / Boat launching</i>
<i>High pressure Air-gasbag</i>	<i>CL-VI</i>	<i>9</i>	<i>1,000 tons ~5,000 tons</i>	<i>< 4%</i>	<i>Deep water buoyancy for sunken ship; Heavy structure and Bigger commercial vessel for ship Launching</i>
<i>Ultra High pressure Air-gasbag</i>	<i>Project based range types airbag</i>	<i>14 ~ 19</i>	<i>5,000 tons ~ 10,000 tons</i>	<i>< 3%</i>	<i>Sharp keel hull conventional ship launching ; Oil tanker ship launching</i>

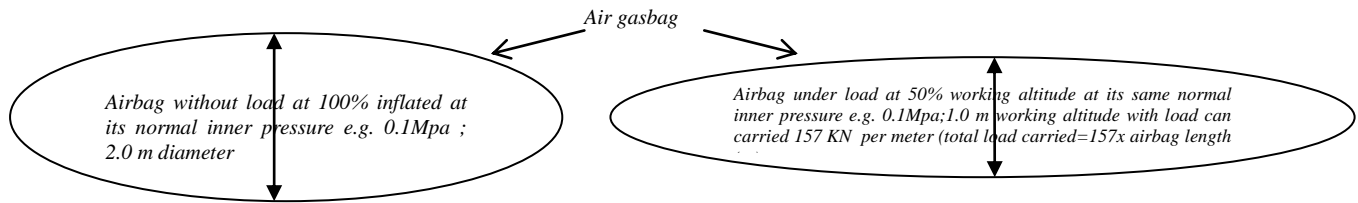
Table 1.1 Types of Air-gasbag selection for application

Types of Air-gasbag	Utricle Nominal Diameter D (m)	Airbag work pressure Pe (Mpa)	Airbag Tested air leakage Pressure Ps (Mpa)	Carried load force capacity per meter (kN/m)			
				Working altitude for diameter of 50%	Working altitude for diameter of 40%	Working altitude for diameter of 30%	Working altitude for diameter of 20%
Low Pressure Air-gasbag	0.8	≤0.125	0.15	79	94	110	126
	1.0	≤0.10	0.12	79	94	110	126
	1.2	≤0.083	0.10	79	94	110	125
	1.5	≤0.067	0.08	79	95	110	126
	1.8	≤0.056	0.067	79	95	111	127
	2.0	≤0.050	0.06	79	94	109	126
	2.4	≤0.042	0.05	79	102	111	127
High Pressure Air-gasbag	0.8	≤0.25	0.30	157	188	218	250
	1.0	≤0.20	0.24	157	188	220	250
	1.2	≤0.166	0.20	156	188	220	250
	1.5	≤0.134	0.16	158	189	220	25.2
	1.8	≤0.11	0.132	155	190	222	253

	2.0	≤0.10	0.12	157	188	219	250
	2.4	≤0.084	0.10	158	203	221	253
Ultra high pressure Air-gasbag	0.8	≤0.40	0.52	251	302	352	-
	1.0	≤0.30	0.39	236	283	300	-
	1.2	≤0.25	0.325	236	283	330	-
	1.5	≤0.21	0.273	247	297	346	-
	1.8	≤0.17	0.221	240	288	336	-

Table 1.2 Effective load carried against working altitude of Air-gasbag

(Above table tested accordance with regional CB standard (GB/T 3837- 1998) by Technological Requirements for Ship Upgrading or Launching Relaying on Airbags)



Remark: The flexibility of the nature characteristic of Air gasbag under go with the different bottom shape of rigid load material carried. Thus, carried load area may vary against load carried when mobilize. Please find table 1.2 for suitable application by every effective length meter of Air-gasbag load carried)

Load carried calculation

Load carried (KN)
where

$$Q = P \cdot S \times 10^3 \text{ (KN)}$$

P = Air gasbag inner pressure (Mpa)
 S = Contact area of load rigid body with Air gasbag (m²)

TYPE MODEL	Nylon Reinforcement Layer	Guaranteed working pressure (Safety pressure limit)					
		D= 0.8m (D= 2.62 ft)	D=1.0m (D=3.28 ft)	D=1.2m (D=3.94 ft)	D= 1.5m (D=4.92 ft)	D= 1.8m (D=5.90 ft)	D= 2.0m (D= 6.56 ft)
CL – 3	3 layer	0.13 MPa (18.85 psi)	0.10 MPa (14.50 psi)	0.09 MPa (13.05 psi)	0.07 MPa (10.15 psi)	0.06 MPa (8.70 psi)	0.05 MPa (7.25 psi)
CL – 4	4 layer	0.17 MPa (24.66 psi)	0.13 MPa (18.85 psi)	0.11 MPa (15.95 psi)	0.09 MPa (13.05 psi)	0.08 MPa (11.60 psi)	0.07 MPa (10.15 psi)
CL – 5	5 layer	0.21 MPa (30.46 psi)	0.17 MPa (24.66 psi)	0.14 MPa (20.31 psi)	0.11 MPa (15.95 psi)	0.09 MPa (13.05 psi)	0.08 MPa (11.60 psi)
CL – 6	6 layer	0.25 MPa (36.26 psi)	0.20 MPa (29.01 psi)	0.17 MPa (24.66 psi)	0.13 MPa (18.85 psi)	0.11 MPa (15.95 psi)	0.10 MPa (14.50 psi)

Table 1.3 CL model Marine Inflatable Airbag Safety limit for Working Pressure

CL-3 型高承载力船用橡胶气囊单位长度的承载力
CL-3 model hoisting bearing Rubber Airbag Capacity

气囊直径 Diameter	工作压力 Working pressure	工作高度 Working height	单位长度的承载力保证值 Guaranteed bearing capacity per unit length		
			kN / m	t / m	lb / ft
D =0.8 m (D=2.62 ft)	0.13MPa (18.85 psi)	0.5 m (1.640 ft)	61.31	6.25	4200
		0.4 m (1.312 ft)	81.72	8.33	5599
		0.3 m (0.984 ft)	102.22	10.42	7004
		0.2 m (0.656 ft)	122.63	12.50	8402
D =1.0 m (D=3.28 ft)	0.1 MPa (14.50 psi)	0.6 m (1.968 ft)	62.88	6.41	4308
		0.5 m (1.640 ft)	78.58	8.01	5384
		0.4 m (1.312 ft)	94.27	9.61	6459
		0.3 m (0.984 ft)	110.07	11.22	7541
		0.2 m (0.656 ft)	125.76	12.82	8617
D =1.2 m (D=3.94 ft)	0.09 MPa (13.05 psi)	0.7 m (2.296 ft)	70.73	7.21	4846
		0.6 m (1.968 ft)	84.86	8.65	5814
		0.5 m (1.640 ft)	98.98	10.09	6782
		0.4 m (1.312 ft)	113.21	11.54	7756
		0.3 m (0.984 ft)	127.33	12.98	8724
		0.2 m (0.656 ft)	141.46	14.42	9692
D =1.5 m (D=4.92 ft)	0.07 MPa (10.15 psi)	0.9 m (2.952 ft)	66.02	6.73	4523
		0.8 m (2.624 ft)	77.01	7.85	5276
		0.7 m (2.296 ft)	88.00	8.97	6029
		0.6 m (1.968 ft)	98.98	10.09	6782
		0.5 m (1.640 ft)	110.07	11.22	7541
		0.4 m (1.312 ft)	121.06	12.34	8294
		0.3 m (0.984 ft)	132.04	13.46	9047
		0.2 m (0.656 ft)	143.03	14.58	9800
D =1.8 m (D=5.90 ft)	0.06 MPa (8.70 psi)	1.1 m (3.608 ft)	61.61	6.28	4221
		1.0 m (3.280 ft)	70.34	7.17	4819
		0.9 m (2.952 ft)	79.26	8.08	5431
		0.8 m (2.624 ft)	88.00	8.97	6029
		0.7 m (2.296 ft)	96.82	9.87	6634
		0.6 m (1.968 ft)	105.56	10.76	7232
		0.5 m (1.640 ft)	114.38	11.66	7837
		0.4 m (1.312 ft)	123.21	12.56	8442
		0.3 m (0.984 ft)	132.04	13.46	9047
D =2.0 m (D=6.56ft)	0.05 MPa (7.25 psi)	1.2 m (3.936 ft)	62.88	6.41	4308
		1.1 m (3.608 ft)	70.73	7.21	4846
		1.0 m (3.280 ft)	78.58	8.01	5384
		0.9 m (2.952 ft)	86.43	8.81	5921
		0.8 m (2.624 ft)	94.27	9.61	6459
		0.7 m (2.296 ft)	102.12	10.41	6997
		0.6 m (1.968 ft)	110.07	11.22	7541
		0.5 m (1.640 ft)	117.92	12.02	8079
		0.4 m (1.312 ft)	125.76	12.82	8617

		0.3 m (0.984 ft)	133.61	13.62	9154
		0.2 m (0.656 ft)	141.46	14.42	9692

CL-4 型高承载力船用橡胶气囊单位长度的承载力
CL-4 model Hoisting Bearing Rubber Airbag Capacity

气囊直径 Diameter	工作压力 Working pressure	工作高度 Working height	单位长度的承载力保证值 Guaranteed bearing capacity per unit length		
			kN / m	t / m	lb / ft
D =0.8 m (D=2.62 ft)	0.17 MPa (24.66 psi)	0.5 m (1.640 ft)	80.15	8.17	5491
		0.4 m (1.312 ft)	106.83	10.89	7319
		0.3 m (0.984 ft)	133.61	13.62	9154
		0.2 m (0.656 ft)	160.30	16.34	10983
D =1.0 m (D=3.28 ft)	0.13 MPa (18.85 psi)	0.6 m (1.968 ft)	81.72	8.33	5599
		0.5 m (1.640 ft)	102.12	10.41	6997
		0.4 m (1.312 ft)	122.53	12.49	8395
		0.3 m (0.984 ft)	143.03	14.58	9800
		0.2 m (0.656 ft)	163.43	16.66	11198
D =1.2 m (D=3.94 ft)	0.11 MPa (15.95 psi)	0.7 m (2.296 ft)	86.43	8.81	5921
		0.6 m (1.968 ft)	103.69	10.57	7104
		0.5 m (1.640 ft)	121.06	12.34	8294
		0.4 m (1.312 ft)	138.32	14.10	9477
		0.3 m (0.984 ft)	155.59	15.86	10660
		0.2 m (0.656 ft)	172.85	17.62	11843
D =1.5 m (D=4.92 ft)	0.09 MPa (13.05 psi)	0.9 m (2.952 ft)	84.86	8.65	5814
		0.8 m (2.624 ft)	98.98	10.09	6782
		0.7 m (2.296 ft)	113.21	11.54	7756
		0.6 m (1.968 ft)	127.33	12.98	8724
		0.5 m (1.640 ft)	141.46	14.42	9692
		0.4 m (1.312 ft)	155.59	15.86	10660
		0.3 m (0.984 ft)	169.71	17.30	11628
		0.2 m (0.656 ft)	183.94	18.75	12602
D =1.8 m (D=5.90 ft)	0.08 MPa (11.60 psi)	1.1 m (3.608 ft)	88.09	8.98	6036
		1.0 m (3.280 ft)	100.65	10.26	6896
		0.9 m (2.952 ft)	113.21	11.54	7756
		0.8 m (2.624 ft)	125.76	12.82	8617
		0.7 m (2.296 ft)	138.32	14.10	9477
		0.6 m (1.968 ft)	150.88	15.38	10337
		0.5 m (1.640 ft)	163.53	16.67	11204
		0.4 m (1.312 ft)	175.60	17.90	12031
		0.3 m (0.984 ft)	186.68	19.03	12791
		0.2 m (0.656 ft)	201.11	20.50	13779
D =2.0 m (D=6.56 ft)	0.07 MPa (10.15 psi)	1.2 m (3.936 ft)	88.09	8.98	6036
		1.1 m (3.608 ft)	99.08	10.10	6788
		1.0 m (3.280 ft)	110.07	11.22	7541
		0.9 m (2.952 ft)	121.06	12.34	8294
		0.8 m (2.624 ft)	132.04	13.46	9047
		0.7 m (2.296 ft)	143.03	14.58	9800
		0.6 m (1.968 ft)	154.02	15.70	10552
		0.5 m (1.640 ft)	165.00	16.82	11305
0.4 m (1.312 ft)	176.19	17.96	12071		

		0.3 m (0.984 ft)	187.37	19.10	12838
		0.2 m (0.656 ft)	201.20	20.51	13785

CL-5 型高承载力船用橡胶气囊单位长度的承载力
CL-5 model Hoisting Bearing Rubber Airbag Capacity

气囊直径 Diameter	工作压力 Working pressure	工作高度 Working height	单位长度的承载力保证值 Guaranteed bearing capacity per unit length		
			kN / m	t / m	lb / ft
D =0.8 m (D=2.62 ft)	0.21 MPa (30.46 psi)	0.5 m (1.640 ft)	98.98	10.09	6782
		0.4 m (1.312 ft)	132.04	13.46	9047
		0.3 m (0.984 ft)	165.00	16.82	11305
		0.2 m (0.656 ft)	198.06	20.19	13570
D =1.0 m (D=3.28 ft)	0.17 MPa (24.66 psi)	0.6 m (1.968 ft)	106.93	10.90	7326
		0.5 m (1.640 ft)	133.61	13.62	9154
		0.4 m (1.312 ft)	160.30	16.34	10983
		0.3 m (0.984 ft)	187.08	19.07	12818
		0.2 m (0.656 ft)	213.86	21.80	14652
D =1.2 m (D=3.94 ft)	0.14 MPa (20.31 psi)	0.7 m (2.296 ft)	110.07	11.22	7541
		0.6 m (1.968 ft)	132.04	13.46	9047
		0.5 m (1.640 ft)	154.02	15.70	10552
		0.4 m (1.312 ft)	175.99	17.94	12058
		0.3 m (0.984 ft)	198.06	20.19	13570
		0.2 m (0.656 ft)	220.04	22.43	15076
D =1.5 m (D=4.92 ft)	0.11 MPa (15.95 psi)	0.9 m (2.952 ft)	103.79	10.58	7111
		0.8 m (2.624 ft)	121.06	12.34	8294
		0.7 m (2.296 ft)	138.32	14.10	9477
		0.6 m (1.968 ft)	155.59	15.86	10660
		0.5 m (1.640 ft)	172.85	17.62	11843
		0.4 m (1.312 ft)	190.22	19.39	13033
		0.3 m (0.984 ft)	207.48	21.15	14216
		0.2 m (0.656 ft)	224.75	22.91	15398
D =1.8 m (D=5.90 ft)	0.09 MPa (13.05 psi)	1.1 m (3.608 ft)	99.08	10.10	6788
		1.0 m (3.280 ft)	113.21	11.54	7756
		0.9 m (2.952 ft)	127.33	12.98	8724
		0.8 m (2.624 ft)	141.46	14.42	9692
		0.7 m (2.296 ft)	155.59	15.86	10660
		0.6 m (1.968 ft)	169.71	17.30	11628
		0.5 m (1.640 ft)	183.94	18.75	12602
		0.4 m (1.312 ft)	198.06	20.19	13570
		0.3 m (0.984 ft)	212.19	21.63	14538
		0.2 m (0.656 ft)	226.32	23.07	15506
D =2.0 m (D=6.56ft)	0.08 MPa (11.60 psi)	1.2 m (3.936 ft)	100.65	10.26	6896
		1.1 m (3.608 ft)	113.21	11.54	7756
		1.0 m (3.280 ft)	125.76	12.82	8617
		0.9 m (2.952 ft)	138.32	14.10	9477
		0.8 m (2.624 ft)	150.88	15.38	10337
		0.7 m (2.296 ft)	163.43	16.66	11198
		0.6 m (1.968 ft)	175.99	17.94	12058
		0.5 m (1.640 ft)	188.55	19.22	12918
0.4 m (1.312 ft)	201.20	20.51	13785		

		0.3 m (0.984 ft)	213.76	21.79	14646
		0.2 m (0.656 ft)	226.51	23.09	15519

CL-6 型高承载力船用橡胶气囊单位长度的承载力
CL-6 model Hoisting Bearing Rubber Airbag Capacity

气囊直径 Diameter	工作压力 Working pressure	工作高度 Working height	单位长度的承载力保证值 Guaranteed bearing capacity per unit length		
			kN / m	t / m	lb / ft
D =0.8 m (D=2.62 ft)	0.25 MPa (36.26 psi)	0.5 m (1.640 ft)	117.92	12.02	8079
		0.4 m (1.312 ft)	157.16	16.02	10768
		0.3 m (0.984 ft)	196.49	20.03	13463
		0.2 m (0.656 ft)	235.73	24.03	16151
D =1.0 m (D=3.28 ft)	0.20 MPa (29.01 psi)	0.6 m (1.968 ft)	125.76	12.82	8617
		0.5 m (1.640 ft)	157.16	16.02	10768
		0.4 m (1.312 ft)	188.65	19.23	12925
		0.3 m (0.984 ft)	220.04	22.43	15076
		0.2 m (0.656 ft)	251.53	25.64	17233
D =1.2 m (D=3.94 ft)	0.17 MPa (24.66 psi)	0.7 m (2.296 ft)	133.61	13.62	9154
		0.6 m (1.968 ft)	160.30	16.34	10983
		0.5 m (1.640 ft)	187.08	19.07	12818
		0.4 m (1.312 ft)	213.76	21.79	14646
		0.3 m (0.984 ft)	240.44	24.51	16474
		0.2 m (0.656 ft)	267.22	27.24	18309
D =1.5 m (D=4.92 ft)	0.13 MPa (18.85 psi)	0.9 m (2.952 ft)	122.63	12.50	8402
		0.8 m (2.624 ft)	143.03	14.58	9800
		0.7 m (2.296 ft)	163.43	16.66	11198
		0.6 m (1.968 ft)	183.94	18.75	12602
		0.5 m (1.640 ft)	204.34	20.83	14000
		0.4 m (1.312 ft)	224.75	22.91	15398
		0.3 m (0.984 ft)	245.15	24.99	16797
		0.2 m (0.656 ft)	267.81	27.30	18349
D =1.8 m (D=5.90 ft)	0.11 MPa (15.95 psi)	1.1 m (3.608 ft)	120.96	12.33	8287
		1.0 m (3.280 ft)	138.22	14.09	9470
		0.9 m (2.952 ft)	155.59	15.86	10660
		0.8 m (2.624 ft)	172.85	17.62	11843
		0.7 m (2.296 ft)	190.22	19.39	13033
		0.6 m (1.968 ft)	207.48	21.15	14216
		0.5 m (1.640 ft)	224.75	22.91	15398
		0.4 m (1.312 ft)	242.01	24.67	16581
		0.3 m (0.984 ft)	259.38	26.44	17771
		0.2 m (0.656 ft)	276.64	28.20	18954
D =2.0 m (D=6.56 ft)	0.10 MPa (14.50 psi)	1.2 m (3.936 ft)	125.76	12.82	8617
		1.1 m (3.608 ft)	141.46	14.42	9692
		1.0 m (3.280 ft)	157.16	16.02	10768
		0.9 m (2.952 ft)	172.85	17.62	11843
		0.8 m (2.624 ft)	188.64	19.23	12925
		0.7 m (2.296 ft)	204.34	20.83	14000
		0.6 m (1.968 ft)	220.04	22.43	15076
		0.5 m (1.640 ft)	235.73	24.03	16151
		0.4 m (1.312 ft)	251.43	25.63	17227

		0.3 m (0.984 ft)	267.13	27.23	18302
		0.2 m (0.656 ft)	282.92	28.84	19384

All CL Model – Rubber Airbag Air Volumetric Container

Length	Volume of an airbag (Theoretical value)					
	D=0.8m	D=1.0m	D=1.2m	D=1.5m	D=1.8m	D=2.0m
5 m	2.75m ³	4.38m ³	6.44m ³	10.36m ³	15.37m ³	19.33m ³
6 m	3.25m ³	5.17m ³	7.57m ³	12.13m ³	17.91m ³	22.47m ³
7 m	3.75m ³	5.95m ³	8.70m ³	13.90m ³	20.45m ³	25.62m ³
8 m	4.25m ³	6.74m ³	9.83m ³	15.67m ³	23.00m ³	28.76m ³
9 m	4.76m ³	7.52m ³	10.96m ³	17.43m ³	25.54m ³	31.90m ³
10 m	5.26m ³	8.31m ³	12.09m ³	19.20m ³	28.09m ³	35.04m ³
11 m	5.76m ³	9.09m ³	13.22m ³	20.97m ³	30.63m ³	38.18m ³
12 m	6.26m ³	9.88m ³	14.35m ³	22.73m ³	33.18m ³	41.32m ³
13 m	6.77m ³	10.66m ³	15.49m ³	24.50m ³	35.72m ³	44.46m ³
14 m	7.27m ³	11.45m ³	16.62m ³	26.27m ³	38.27m ³	47.61m ³
15 m	7.77m ³	12.23m ³	17.75m ³	28.04m ³	40.81m ³	50.75m ³
16 m	8.27m ³	13.02m ³	18.88m ³	29.80m ³	43.36m ³	53.89m ³
17 m	8.78m ³	13.80m ³	20.01m ³	31.57m ³	45.90m ³	57.03m ³
18 m	9.28m ³	14.59m ³	21.14m ³	33.34m ³	48.45m ³	60.17m ³

CL-3 model Marine Inflatable Rubber Airbag (Airbag weight)

Length	Weight of an airbag (Theoretical value)					
	D=0.8m	D=1.0m	D=1.2m	D=1.5m	D=1.8m	D=2.0m
5 m	78 kg	100 kg	125 kg	163 kg	204 kg	233 kg
6 m	91 kg	117 kg	145 kg	187 kg	234 kg	267 kg
7 m	104 kg	134 kg	165 kg	212 kg	263 kg	300 kg
8 m	117 kg	150 kg	185 kg	237 kg	293 kg	333 kg
9 m	130 kg	166 kg	203 kg	262 kg	323 kg	366 kg
10 m	144 kg	183 kg	223 kg	287 kg	353 kg	399 kg
11 m	157 kg	199 kg	243 kg	312 kg	383 kg	432 kg
12 m	170 kg	216 kg	263 kg	337 kg	413 kg	465 kg
13 m	183 kg	232 kg	283 kg	362 kg	443 kg	498 kg
14 m	196 kg	249 kg	303 kg	387 kg	473 kg	531 kg
15 m	209 kg	266 kg	323 kg	412 kg	503 kg	564 kg
16 m	222 kg	283 kg	343 kg	437 kg	533 kg	597 kg
17 m	235 kg	300 kg	363 kg	462 kg	563 kg	630 kg
18 m	248 kg	317 kg	383 kg	487 kg	593 kg	663 kg

CL-4 model Marine Inflatable Rubber Airbag (Airbag weight)

Length	Weight of an airbag (Theoretical value)					
	D=0.8m	D=1.0m	D=1.2m	D=1.5m	D=1.8m	D=2.0m
5 m	89 kg	112 kg	143 kg	187 kg	234 kg	268 kg
6 m	105 kg	131 k	166 kg	216 kg	269 kg	307 kg
7 m	120 kg	150 kg	188 kg	245 kg	303 kg	345 kg
8 m	135 kg	168 kg	211 kg	273 kg	337 kg	383 kg
9 m	150 kg	191 kg	234 kg	301 kg	372 kg	421 kg
10 m	165 kg	210 kg	257 kg	330 kg	406 kg	459 kg
11 m	181 kg	229 kg	280 kg	359 kg	441 kg	497 kg
12 m	196 kg	249 kg	303 kg	388 kg	476 kg	535 kg
13 m	211 kg	268 kg	326 kg	417 kg	511 kg	573 kg
14 m	226 kg	288 kg	349 kg	446 kg	546 kg	611 kg
15 m	241 kg	307 kg	372 kg	475 kg	581 kg	649 kg
16 m	256 kg	326 kg	395 kg	504 kg	616 kg	687 kg
17 m	271 kg	344 kg	418 kg	533 kg	651 kg	725 kg
18 m	286 kg	364 kg	441 kg	562 kg	686 kg	763 kg

CL-5 model Marine Inflatable Rubber Airbag (Airbag weight)

Length	Weight of an airbag (Theoretical value)					
	D=0.8m	D=1.0m	D=1.2m	D=1.5m	D=1.8m	D=2.0m
5 m	107 kg	138 kg	171 kg	223 kg	281 kg	321 kg
6 m	125 kg	161 kg	198 kg	258 kg	322 kg	367 kg
7 m	143 kg	184 kg	226 kg	292 kg	363 kg	412 kg
8 m	161 kg	206 kg	253 kg	326 kg	404 kg	458 kg
9 m	180 kg	229 kg	280 kg	361 kg	445 kg	504 kg
10 m	198 kg	252 kg	308 kg	395 kg	486 kg	550 kg
11 m	216 kg	275 kg	335 kg	429 kg	527 kg	596 kg
12 m	234 kg	298 kg	362 kg	463 kg	568 kg	642 kg
13 m	252 kg	321 kg	389 kg	497 kg	609 kg	688 kg
14 m	270 kg	344 kg	416 kg	531 kg	650 kg	734 kg
15 m	288 kg	367 kg	443 kg	565 kg	691 kg	780 kg
16 m	306 kg	390 kg	470 kg	599 kg	732 kg	826 kg
17 m	324 kg	413 kg	497 kg	633 kg	773 kg	872 kg
18 m	342 kg	436 kg	524 kg	667 kg	814 kg	918 kg

CL-6 model Marine Inflatable Rubber Airbag (Airbag weight)

Length	Weight of an airbag (Theoretical value)					
	D=0.8m	D=1.0m	D=1.2m	D=1.5m	D=1.8m	D=2.0m
5 m	121 kg	157 kg	194 kg	254 kg	320 kg	365 kg
6 m	142 kg	183 kg	226 kg	293 kg	367 kg	417 kg
7 m	163 kg	209 kg	257 kg	332 kg	413 kg	469 kg
8 m	183 kg	235 kg	288 kg	371 kg	460 kg	521 kg
9 m	204 kg	260 kg	319 kg	410 kg	506 kg	573 kg
10 m	225 kg	286 kg	350 kg	449 kg	553 kg	625 kg
11 m	246 kg	312 kg	381 kg	488 kg	600 kg	677 kg
12 m	267 kg	338 kg	412 kg	527 kg	647 kg	729 kg
13 m	288 kg	364 kg	443 kg	566 kg	694 kg	781 kg
14 m	309 kg	390 kg	474 kg	605 kg	741 kg	833 kg
15 m	330 kg	416 kg	505 kg	644 kg	788 kg	885 kg
16 m	351 kg	442 kg	536 kg	683 kg	835 kg	937 kg
17 m	372 kg	468 kg	567 kg	722 kg	882 kg	989 kg
18 m	393 kg	494 kg	598 kg	761 kg	929 kg	1041 kg

Note :

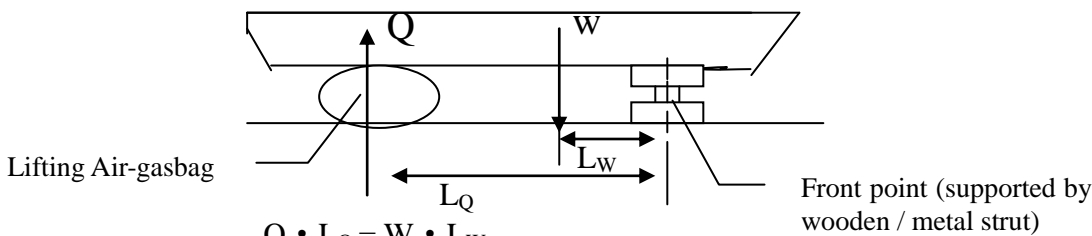
Airbag comply with standard CB standard CB/T 3795-1996 – airbag for ship up to and down to launching way. CB/T 3837 – 1998 (Technological Requirements for Ship launching Relying on Airbag)

(3) Air gasbag procedure for heavy structure mobilization and ship launching process

The application of airbag on mobilized heavy structure becomes widely innovative applicable use in the construction industries, oil & gas, ship launching & marine dredging sector nowadays.

Procedure:

1. Check on the uneven scar causes by welding of heavy steel structure to ensure its smooth surface.
2. Ensure the structure / ship fully welded before mobilized.
3. Tidy up the slope launching slipway to ensure harmful big sharp stone or metal material fully avoided.
4. Mobilization slipway should in the flat and spacey ground where the structure should always place in centre of gravity on top of the airbag.
5. Slope decline not greater than 1/7 however depending on the capability of towing winch machine.
6. Air gasbag working altitude should not less than 0.3 meter from the ground to ensure structure not contact with the ground when slow moving. For the ship launching process the working altitude should not less than 0.5 meter.
7. Attached towing winch with structure should ensure in tight position.
8. To confirm the centre gravity of the structure load by first jacking up the yield point of rear end hull structure in length.



Where Q = Lifting air-gasbag capacity.
 W = centre gravity load
 L_Q = Lifting yield point
 L_W = Centre gravity yield point

9. Adjusted the respective inserted air-gasbag at bottom structure by a distance 0.5 ~ 3.0m. If found sharp keel bottom structure, the distance between the air gasbag should not more that 1.0m.
10. Adjusted the required working altitude should not less than 0.5m by compressed inner pressure selected airbag.
11. Ignition the towing winch by gradually pulling the heavy structure for not greater than velocity 0.5 m/s for 2,000 tons structure. Due to the inertia of the nature object will under moving against centre gravity and friction.
12. By ensuring the Ship or barge in achieving floated position moving into the sea shore during launching process, try to avoid sudden death end of the locus track way as illustrated figure below:

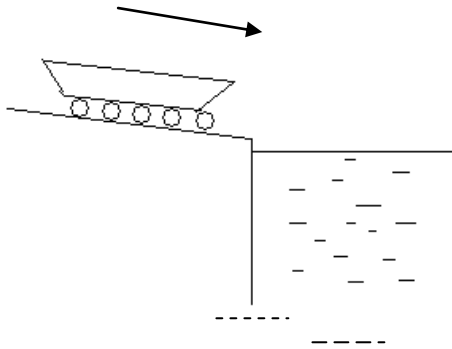


Fig 1.2 Fault of Launching Process

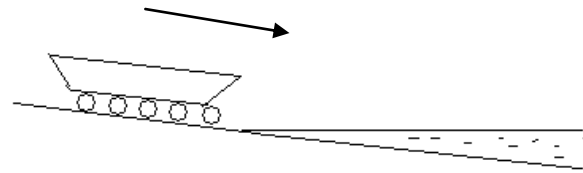


Fig 1.3 Correct way of Launching Process

(5) Criteria in precaution of usage

- The inner pressure of the air-gasbag should not exceed the safety limit air leakage inner pressure shown in Table 1.3
- The load carried object should not have sharp uneven surface.
- To ensure the air gasbag in line balance with the locus destination to avoid the torsion twisted strength.
- When air gasbag is in inflated lifting position, avoid the heavy impact on the airbag.
- Quarterly year routine checking on the surface air gasbag by inflate the airbag excess pressure 1.2 times on FREE load to ensure no air leakage.

(6) Criteria in proper storage

- Air gasbag should always keep in room temperature, dry place to avoid aging process.
- Avoid to contact with acid / alkaline solute chemical and oily petroleum base chemical for long period.
- Avoid of heavy material stay on top of the deflated air gasbag when storing for long period.

MAINTENANCE GUIDE

for

INDUSTRIAL/ MARINE INFLATABLE RUBBER AIR-GASBAG

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Maintenance Guide for Repairing Air-Gasbag Method

When there is air leakage, identified the crack propagation by visual inspection on the Air-Gasbag to check on the rubber characteristic by determine the surface whether seriously aging (fatigue fracture and sticky surface). If found any damage seriously harden or sticky rubber material on the surface outer wall of the Air-gasbag, the patching would not last for long.

- 1. Clean up thoroughly inner and outer Air-gasbag to ensure totally clean especially on the outer wall surface. (Do not immersed into the water more than 10 minutes before patching)
- 2. Marking / identified the air leakage area by extending "wound" part outward $\Phi 15\text{mm}$.
- 3. Structure layer material segregate by 2 - 6 layers depending on the size of flake leakage area. (Eg. Leakage area approx. $\Phi 100\text{mm}$ or propagating fracture 50-70mm will be patching 4-6 layers)

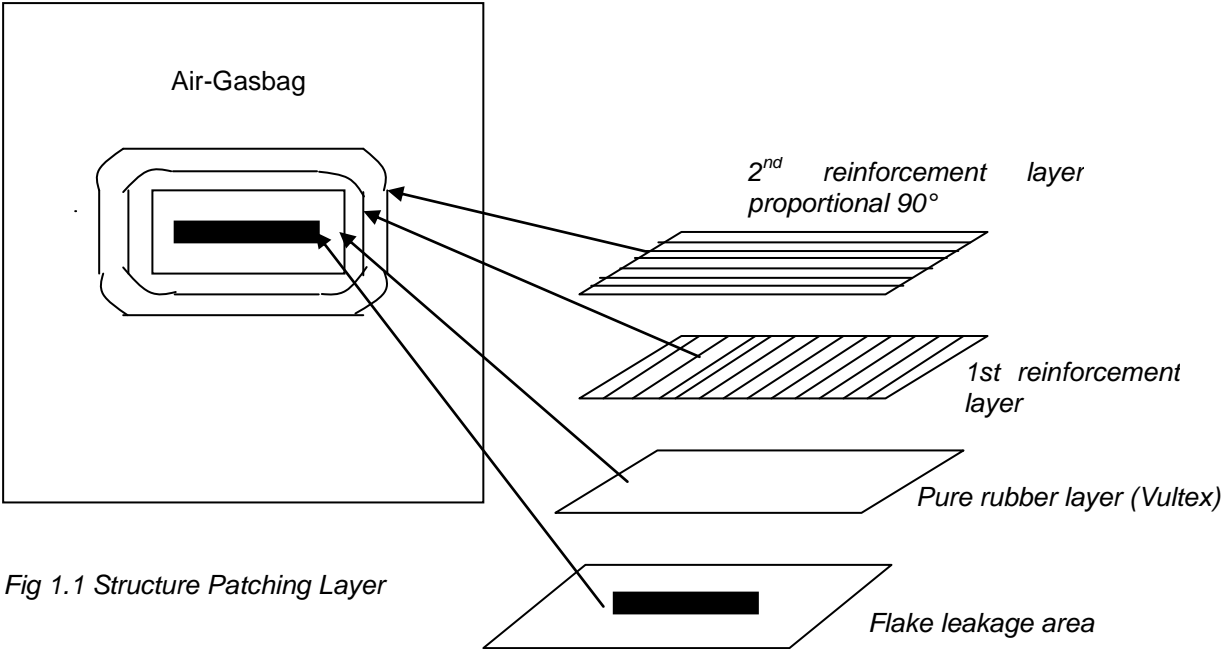


Fig 1.1 Structure Patching Layer

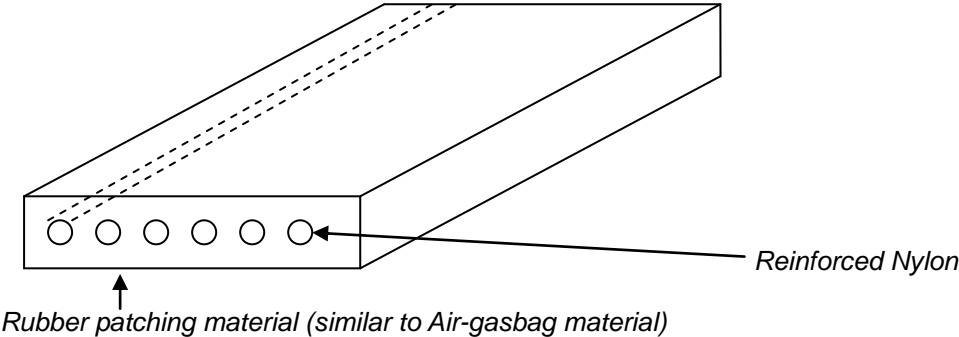


Fig 1.2 Nylon Reinforced Rubber Material

4. Glisten the flake leakage area by sand paper in single way direction for several times to ensure clean & smooth surface surrounding the fracture area. (Remember to clean up with compressed air to be blown through the bed of outer surface)
5. The whole process should ensure there is no unwanted particular embedded and dry up the Air-gasbag surface. Then brush up some owned made 502 glue with the ingredient of glue mixture of pure rubber material : petroleum base chemical of 1:8 as shown fig. 1.1.
6. Patching process - use prepared mentioned layer to stick up accordance to fig 1.1
5. Vulcanizing press process - Using the customized made Patching Rack Structure indicated as fig. 1.3 to carried out Vulcanizing process by heating up to $135 \pm 5^{\circ}\text{C}$; Pressure load pressing 0.08 - 0.12Mpa on the flake leakage area within 40-50 minutes. (Do not excess the heating time period due to over melting the rubber material)
8. Inspection - To visual checking on the patching area ensuring the fully tight stick up the patching layer respectively. Then inflate the Air-gasbag for final checking. Repeat the procedure if found any failure but you need to wait for the patching area fully normal cooling to room temperature. (Do not quenching cooling by pouring any form of liquid or water to avoid increasing the rubber aging process)

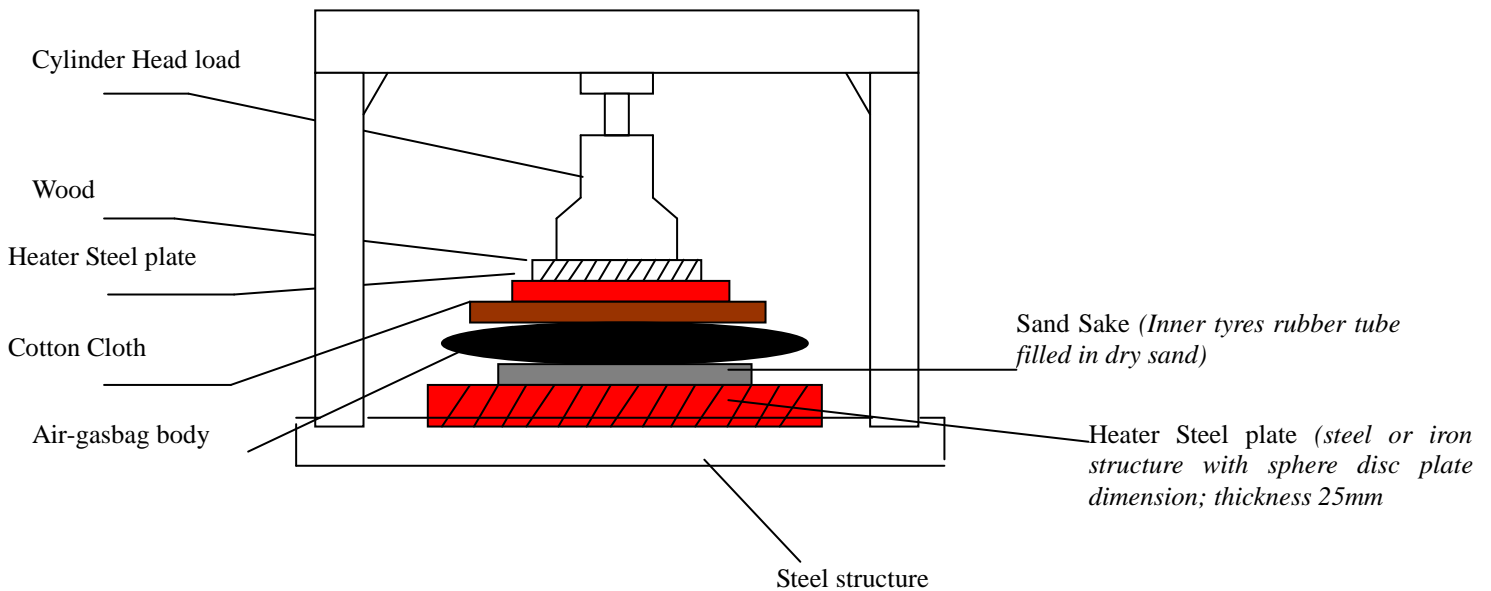


Fig. 1.3 Patching Rack Structure



Fig. 1.4 Vulcanizing process carried out by the technician



Fig 1.5 Heating up temperature 135°C; waiting period 40 ~ 50 minutes