XIII. TABLES AND FIGURES

TABLE XIII-1

SELECTED PROPERTIES OF INHALATION ANESTHETICS

Anesthetic Agent	Common Synonyms	Molecular Formula and Weight		Boiling Point	Vapor Density (Air=1)
Diethyl ether	Ethyl ether Ether	CH3CH2 0 CH2CH3	74.14	-35 C	2.6
Cyclopropane	Trimethylene	C3H6	42	-34 C	1.4
Chloroform	Trichloro-methane	CHC1 3	119.3	61 C	4.1
Nitrous oxide	Nitrous	N2 0	44	-88 C	1.5
Halothane	Fluothane	CF3CHBrC1	197.4	50 C	6.9
Trichloro-ethylene	Ethylene trichloride Trilene	CHC1CC12	131.4	87 C	4.5
Fluroxene	Fluoromar	CF3CH2 0 CHCH2	126	43.2 C	4.4
Methoxy-flurane	Penthrane	CHC12 CF2 0 CH3	165	104 C	5.7
Enflurane	Ethrane	CHC1FCF2 0 CHF2	184.5	56 C	6.4

TABLE XIII-1 (CONTINUED)

SELECTED PROPERTIES OF INHALATION ANESTHETICS

Anesthetic Agent	Specific Gravity (Water=1)	Vapor Pressure mmHg (20 C)	Flammable (Explosive) Limits by Volume in Air	Chemical Abstract's Serial No.	Blood/Gas Partition Coefficient	M.A.C.* Vol %**
Diethyl ether	0.72	425	1.85-36.0%	000060297	15	2.5
Cyclopropane	0.68		2.4-10.3%	000075194	0.46	13
Chloroform	1.47	160	Nonflammable	000067663	10.3	0.62
Nitrous oxide	1.23		"	010024972	0.47	120
Halothane	1.87	243	"	000151677	2.3	0.74
Trichloro-ethylene	1.50	58		000079016	9.15	0.17
Fluroxene	1.13	286	4.2%	000406906	1.37	3.4
Methoxyflurane	1.42	23	7.0%	000076380	13.0	0.20
Enflurane	1.52	175		013838169	1.9	1.7

*M.A.C.= minimum alveolar anesthetic concentration
**1 vol% = 10,000 ppm

From references 1-11

TABLE XIII-2

SUMMARY OF ANESTHETIC GAS CONCENTRATIONS IN LOCATIONS WITHOUT WASTE GAS SCAVENGING

Gases Sampled	Sampling Site	Concentration, ppm Range	Mean	Reference
Nitrous oxide	General air, OR	0-448	130	131
Halothane	"	0-27	10	131
Nitrous oxide	Anesthetist, OR		6,000	132
Halothane	"		85	132
Halothane	"	0-28	8	133
Methoxyflurane	Anesthetist, OR	2-10		134
	Surgeon, OR	1-2		134
Nitrous oxide	Anesthetist, OR	330-9,700		134
	Surgeon, OR	310-550		134
Trichloro-ethylene	Anesthetist, OR	1-103		135
	Surgeon, OR	0.3-1.5		135
Halothane	Anesthetist, OR		8.6	136
Nitrous oxide	"		929	137
Halothane	"		10	137
Nitrous oxide	Personnel, OR		146	137
Halothane	"		3	137
Nitrous oxide	Anesthetist, OR	60-4,900	1,080	138
Halothane	"	3-57	11	138
Nitrous oxide	Personnel, OR	20-1,600	305	138
Halothane	"	1-8	3	138
"	Patient, RR	0.4-0.6		139
"	"	0-0.3 after 1 hr		139
"	Anesthetist, OR	14-59 (TWA)		140

TABLE XIII-2 (CONTINUED)

SUMMARY OF ANESTHETIC GAS CONCENTRATIONS IN LOCATIONS WITHOUT WASTE GAS SCAVENGING

Gases Sampled	Sampling Site	Concentration, ppm Range	Mean	Reference
Halothane	Anesthetist, OR	1-60		141
"	Nearby office	0.4-6		141
Halothane	Anesthetist, DO		23	142
"	"		25	142
"	Surgeon, DO		68	142
"	"		18	142
Trichloro-ethylene	Anesthetist, DO	25-50	25	143
Halothane	Anesthetist, OR	1-14		144
Nitrous oxide	General air, OR	0-1,300	177	145
Halothane	"	0-199	12	145
Enflurane	"	0-234	10	145
Nitrous oxide	General air, DO	94-3,000	793	145
Halothane	"	1.5-36	15.5	145
Nitrous oxide	Dentist, DO		6,767	146
	Dental assistant, DO		5,867	146
Halothane	General air, OR	0-1.6		148
"	Anesthetist, OR	0.1-14	11	149
Nitrous oxide	Personnel, OR	5-6,000	525	150,170
"	"	150-3,000	430	150,170
"	"	20-6,000		150,170
Halothane	"	0-21	3.5	150,170
"	"	0.3-7		150,170
"	"	0.4-29	1.0	150,170

OR=operating room
DO=dental office
RR=recovery room

TABLE XIII-3

SUMMARY OF ANESTHETIC GAS CONCENTRATIONS IN LOCATIONS WITH WASTE GAS SCAVENGING

Gases Sampled	Sampling Site	Concentration Mean, ppm	Waste Gas Control Method	Reference
Halothane	Anesthetist, OR	0.79	Scavenging to wall suction	136
"	"	0.73	"	136
Nitrous oxide	Anesthetist, OR	135	"	137
Halothane	"	0.85	"	137
Nitrous oxide	"	24	Scavenging to air conditioning exhaust grille	173
Halothane	"	1-2	Scavenging to wall suction	141
Nitrous oxide	General air, OR	35	Not given	145
Halothane	"	0.24	"	145
Enflurane	"	0.9	"	145
Halothane	Anesthetist, OR	0.2	Venting to pipe in floor plus 10 room air changes/hr	149
Nitrous oxide	General air, OR	15	Scavenging to	159
"	Anesthetist, OR	18	air-conditioning	159
"	Surgeon, OR	17	exhaust grille,	159
	Scrubnurse, OR	13	all leaks in	159
"	Circulating nurse, OR	14	machine repaired	
"	Dentist, DO	14	Double suction	172
	Anesthetist,DO	7	mask, mouth hook,	
	General air, DO	13	and fan	

OR=operating room
DO=dental office

TABLE XIII-4

CONCENTRATIONS OF NITROUS OXIDE IN ROOM AIR DURING ANESTHESIA WITH SCAVENGING

Anesthetic Technique	No. of Syringe Samples	Average Concentration of N20 (ppm)
Mask	75	36 ± 6.7*
Endotracheal tube	76	15 ± 2.4
Endotracheal tube with ventilator	57	34 ± 7.8
All samples	208	28 ± 3.4

*Standard error

Adapted from Whitcher et al [159]

TABLE XIII-5

COMPARISON OF NITROUS OXIDE CONCENTRATIONS
BY SAMPLE SITE WITH SCAVENGING IN USE

Sample Site	N20 Concentrations ppm ± S.E.*
Exhaust Grille	15 ± 2.7
Anesthetist Breathing Zone	18 ± 2.9
Surgeon's Breathing Zone	17 ± 5.0
Scrub Nurse	13 ± 3.2
Circulating Nurse	14 ± 2.8
Door	14 ± 2.8

*Standard error

Adapted from Whitcher et al [159]

TABLE XIII-6
CLASSIFICATION OF COMMONLY USED
INHALATION ANESTHETIC SYSTEM

(a)	Without CO2 Absorption		
	(1)	Open drop	
	(2)	Insufflation	
	(3)	Mapleson types (semi-closed)	
		(A)	Magill
		(B)	T-tube
	(4)	Nonreturn (nonrebreathing)	
(b)	With CO2 absorption		
	(1)	To-and-fro system	
	(2)	Circle system	
		(A)	Closed system
		(B)	Partial rebreathing (semi-closed)

TABLE XIII-7

HOSPITALS SURVEYED ACCORDING TO
AMERICAN HOSPITAL ASSOCIATION CATEGORIES

Institutional Category	Total Number of Hospitals Within Each Category	Number of Hospitals Surveyed
Governmental, Non-federal	526	400
Non-gov't, Not for Profit	1,963	400
Non-gov't, for Profit	170	170
Governmental-federal	206	206
Osteopathic	77	77
Total	2,942	1,253

Derived from reference 175

TABLE XIII-8

SUMMARY OF SURVEY RESPONSE RATE
BY HOSPITAL CATEGORY

Institutional Category	Total Surveys Mailed	Total Responses Received	% Responses
Governmental, Non-federal	400	302	75
Non-gov't, Not for Profit	400	344	86
Non-gov't, for Profit	170	124	72
Governmental-federal	206	182	88
Osteopathic	77	58	75
Total	1,253	1,009	80

Derived from reference 175

TABLE XIII-9

PERCENTAGE OF ALL HOSPITALS THAT REPORTED USING THE VARIOUS ANESTHETIC AGENTS ACCORDING TO HOSPITAL SIZE

Anesthetic Agents	Hospital Size (No. of Beds) 100-200	200-300	300-500	>500	Not Reported
Nitrous oxide	99.4	100	100	100	94.6
Halothane	97.1	99.5	99.5	100	91.3
Enflurane	42.9	53.6	69.0	68.5	40.9
Isoflurane	1.6	0.5	2.1	1.5	2.2
Methoxyflurane	57.5	56.2	66.3	66.2	57.0
Diethyl ether	19.8	27.9	20.9	30.0	19.4
Trichloroethylene	2.3	6.6	3.7	8.5	6.5
Cyclopropane	47.7	48.3	47.4	50.0	47.6
Chloroform	0.6	1.6	0.6	0.8	0.0
Other	17.5	16.4	20.3	23.1	15.1

Derived from reference 175

TABLE XIII-10

PERCENTAGE OF ALL CASES UTILIZING
VARIOUS ANESTHETIC AGENTS ACCORDING TO HOSPITAL SIZE

Anesthetic Agents	Hospital Size (No. of Beds) 100-200	200-300	300-500	>500	Not Reported
Nitrous oxide	91.9	97.3	92.1	89.1	84.7
Halothane	56.8	50.4	51.9	46.8	49.9
Enflurane	11.3	17.0	15.1	14.9	9.4
Isoflurane	0.4	0.1	0.1	0.2	0.1
Methoxyflurane	6.9	5.7	5.1	5.3	6.3
Diethyl ether	1.8	1.0	0.8	0.9	0.8
Trichloroethylene	0.5	0.8	0.1	0.3	0.1
Cyclopropane	3.0	2.9	3.2	4.1	2.8
Chloroform	0.1	0.5	3.2	0.0	0.0
Other	3.9	3.3	5.0	6.2	4.1

Derived from reference 175

TABLE XIII-11

AVERAGE PERCENTAGE UTILIZATION OF THE ANESTHESIA BREATHING CIRCUITS ACCORDING TO HOSPITAL SIZE

Anesthesia Breathing Circuit	Hospital Size (No. of Beds) 100-200	200-300	300-500	>500	Not Reported
Semiclosed and partial rebreathing	81.9	89.6	84.0	82.5	77.9
Nonrebreathing	9.5	10.9	8.2	7.6	10.7
To-and-fro absorption	2.4	2.2	0.9	0.3	0.1
Closed circle	2.6	1.7	2.0	5.2	2.8
Open drop	0.5	0.3	0.6	0.2	0.5

Derived from reference 175

TABLE XIII-12

AVERAGE PERCENTAGE UTILIZATION OF THE VARIOUS METHODS OF INHALATION ANESTHESIA ADMINISTRATION ACCORDING TO HOSPITAL SIZE

Method of Inhalation Anesthesia Administration	Hospital Size (No. of Beds)				Not Reported
	100-200	200-300	300-500	>500	
Insufflation	1.7	0.9	1.1	1.6	0.8
Endotracheal	54.2	58.7	61.1	65.2	65.2
Face mask (excluding open drop)	43.4	40.2	36.6	30.8	41.4
Other	1.1	0.7	1.1	1.1	1.8

Derived from reference 175

TABLE XIII-13

PERCENTAGE OF ALL HOSPITALS THAT REPORT USING WASTE ANESTHETIC GAS SCAVENGING* ACCORDING TO HOSPITAL SIZE

Hospital Size (No. of Beds)	Percentage Using Waste Anesthetic Gas Scavenging
100-200	65.0
200-300	73.8
300-500	74.9
>500	75.2
Not Reported	65.6

*Scavenging techniques considered are the use of either connections to the nonrecirculating air-conditioning system, central vacuum system, or a special duct system to vent waste gases from the operating room. Venting to the floor, if reported, was not considered waste anesthetic gas scavenging.

TABLE XIII-14

ANESTHETIC GAS INHALATION EXPOSURES AND EFFECTS ON HUMANS

Exposure Variables	Exposure Time	Effects	Reference
Trichloroethylene, 110 ppm	Two 4-hr periods	Decrements in performance ability	44
Trichloroethylene, 1,000 ppm	2 hr	Developed optokinetic nystagmus	40
Trichloroethylene, 100, 300, 1,000 ppm	"	Psychophysiologic decrements at 1,000 ppm	41
Trichloroethylene, 100, 200, 300, 500 ppm	2.5 hr	Psychophysiologic decrements at 300 and 500 ppm	42
Trichloroethylene, 265 and 211 ppm (TWA)	83 and 190 min	No effect reported	43
Trichloroethylene, 200 ppm	7 hr/d for 5 d	"	
Trichloroethylene, 110 ppm	4 hr	"	
Nitrous oxide, 500 ppm	Two 4-hr exposures	Digit-span test decrements	47
Nitrous oxide, 500 ppm plus halothane, 15 ppm	"	Psychologic performance decrements	
Nitrous oxide, 500 ppm plus enflurane, 15 ppm	4 hr	"	
Nitrous oxide, 50 ppm plus halothane, 1 ppm	2-4 hr	Memory, cognition, and psychomotor decrements	49
Nitrous oxide, 50 ppm	"	Audiovisual performance decrements	49
Diethyl ether, nitrous oxide, halothane, and other agents	During work hours (survey)	Increased headache, fatigue, nausea, spontaneous abortions	69

TABLE XIII-14 (CONTINUED)

ANESTHETIC GAS INHALATION EXPOSURES AND EFFECTS ON HUMANS

Exposure Variables	Exposure Time	Effects	Reference
Specific agents not given	During work hours (mortality study)	Increased suicide and malignancies	70
"	During work hours (survey)	Increased spontaneous abortions, premature deliveries, fewer males born	72
"	During work hours (interview and survey)	Increased spontaneous abortions	73
"	During work hours (survey)	Increased spontaneous abortions, congenital anomalies, and involuntary infertility	74
"	"	Increased incidence of cancer among nurses	75
"	"	Increased incidence of congenital anomalies	75
"	"	Increased incidences of spontaneous abortions, congenital anomalies, hepatic and renal diseases, and cancer	12 13
"	1 yr and 8 mon before and during pregnancy (survey)	Increased incidences of spontaneous abortions, congenital anomalies, and premature births	77

TABLE XIII-14 (CONTINUED)

ANESTHETIC GAS INHALATION EXPOSURES AND EFFECTS ON HUMANS

Exposure Variables	Exposure Time	Effects	Reference
Specific agents not given	During work hours (survey)	Increased spontaneous abortions, headache, fatigue, liver and kidney disorders	78
"	"	Decrease in number of male children born	79
"	"	Increased incidences of spontaneous abortions and congenital anomalies	80

TABLE XIII-15

ANESTHETIC GAS INHALATION EXPOSURES AND EFFECTS ON ANIMALS

Species	Exposure Concentration and Duration	Effects	Reference
Rats	700,000 ppm nitrous oxide 8 d	Decreased white blood cell count, alteration in RNA/DNA ratio	93
Guinea pigs	10,000 ppm halothane 1-5 times for 1 hr each	Focal hepatic lesions, hepatic necrosis	94
Rats	2,500 ppm methoxyflurane 1.5 hr	No kidney damage reported	95
"	5,000 ppm methoxyflurane 3 hr	Mitochondrial changes in kidneys	95
"	7,500 ppm methoxyflurane 6 hr	Damage to convoluted tubules in kidneys	95
"	200 ppm methoxyflurane 7 hr/d, 5 d/wk, 7 wk	Moderate hepatic fatty infiltration	96
"	500 ppm halothane 7 hr/d, 5 d/wk, 7 wk	Increased liver weight and hepatic fatty infiltration	96
"	2,000 ppm diethyl ether 7 hr/d, 5 d/wk, 7 wk	No hepatotoxic responses reported	96
Guinea pigs	200 ppm methoxyflurane 7 hr/d, 5 d/wk, 7 wk	Increased liver weight and hepatic fatty infiltration	96
"	500 ppm halothane 7 hr/d, 5 d/wk, 7 wk	Minimal to moderate central lobular hepatic fatty infiltration	96
"	2,000 ppm diethyl ether 7 hr/d, 5 d/wk, 7 wk	No hepatotoxic responses reported	96
Rabbits	200 ppm methoxyflurane 7 hr/d, 5 d/wk, 7 wk	Elevated SGOT and SGPT levels, moderate hepatic fatty infiltration	96
"	500 ppm halothane 7 hr/d, 5 d/wk, 7 wk	Minimal hepatic central lobular fatty infiltration	96

TABLE XIII-15 (CONTINUED)

ANESTHETIC GAS INHALATION EXPOSURES AND EFFECTS ON ANIMALS

Species	Exposure Concentration and Duration	Effects	Reference
Rabbits	2,000 ppm diethyl ether 7 hr/d, 5 d/wk, 7 wk	No hepatotoxic responses reported	96
Rats, mice,	15, 50, 150, 300 ppm halothane, 5 wk	Dose-related weight gain decrements and number of liver lesions	61
Guinea pigs	150, 500, 1,500 ppm isoflurane, 5 wk	Little or no increase in the number of liver lesions with dose	61
"	1,000 and 10,000 ppm diethyl ether, 5 wk	"	
Rats	10 ppm halothane 8 hr/d, 5 d/wk, 8 wk	Ultrastructural changes in neuronal tissues	97
"	500 ppm halothane 8 hr/d, 5 d/wk, 4 wk	Marked ultrastructural changes in neuronal tissues	97
"	10 ppm halothane 8 8 hr/d, 5 d/wk, 8 wk	Ultrastructural changes in liver and kidney tissues	98,99
"	500 ppm halothane 8 hr/d, 5 d/wk, 4 wk	Cellular and ultrastructural changes in liver and kidney tissues	98,99

TABLE XIII-15 (CONTINUED)

ANESTHETIC GAS INHALATION EXPOSURES AND EFFECTS ON ANIMALS

Species	Exposure Concentration and Duration	Effects	Reference
Rats	8-12 ppm halothane 8 hr/d, 5 d/wk, conception-d 60 of age	Permanent learning deficits and neuronal damage	119
"	8-12 ppm halothane 8 hr/d, 5 d/wk, after day 60 of age	No learning deficits reported	119
Pregnant rats	10 ppm halothane 8 hr/d, 5 d/wk, throughout pregnancy	Cellular and ultrastructural damage in fetal liver, kidney, and brain tissues	111 112 113
"	30, 100, or 300 ppm chloroform 7 hr/d, days 6-15 of gestation	Fetal abnormalities at 100 and 300 ppm	120
"	500,000 ppm nitrous oxide 2, 4, or 6 d	Increased fetal death rate and vertebral anomalies	108
"	700,000 ppm nitrous oxide 1 d during days 5-11 of pregnancy	Fetal skeletal anomalies, peak effect on day 9	109
"	8,000 ppm nitrous oxide 12-hr periods during pregnancy	Increased fetal sketetal malformations following exposure on day 8 or 9.5	110
Pregnant mice	10,000 or 15,000 ppm halothane 3 hr on day 12, 13, 14, or 15 of pregnancy	Increased incidence of cleft palate and limb developmental defects	121
Pregnant hamsters	600,000 nitrous oxide plus 6,000 ppm halothane 3 hr, on day 9, 10, or 11 of pregnancy	Increased fetal resorptions (abortions)	116
Pregnant rats	Halothane/nitrous oxide anesthesia 6-12 hr, 6-10 of pregnancy	Increased fetal resorption (abortion) rate with increased halothane concentration	115

TABLE XIII-15 (CONTINUED)

ANESTHETIC GAS INHALATION EXPOSURES AND EFFECTS ON ANIMALS

Species	Exposure Concentration and Duration	Effects	Reference
Pregnant rats	Halothane/nitrous oxide anesthesia, 6-12 hr during pregnancy	Increased vertebral anormalies but not proportional to halothane	115
"	100, 1,000, and 15,000 ppm nitrous oxide, 8 or 24 hr/d during pregnancy	Higher fetal death rates at 1,000 and 15,000 ppm nitrous oxide	122
Mice, M and F	16 ppm halothane 7 hr/d, 5 d/wk, 6 wk	No adverse reproductive effects reported	123
Rats, M	200,000 ppm nitrous oxide, 8 or 24 hr/d, up to 35 d	Spermatogenesis affected, reversible	124
Pregnant mice	1,000 or 5,000 ppm isoflurane during pregnancy; offspring exposed at 1,000 ppm. All 2-hr exposures	Hepatic neoplasms in males	130
Pregnant rats	1.35, 1.43, and 1.43% halothane 1 hr/d on days 1-5, 6-10, or 11-15 of pregnancy	Incomplete ossification centers in rats exposed on days 11-15; considered incidental by authors	125
Pregnant rabbits	2.16, 2.16, and 2.3% halothane 1 hr/d on days 6-9, 10-14, or 15-18 of pregnancy	Some incomplete centers of ossification found	125
Rats, M and F	1.48, 1.34, and 1.4% halothane 1 hr/d 1-5, 6-10, or 11-15 d prior to pairing	No effect on fertility	125
Pregnant rats	50, 100, 200, 800, 1,600, and 3,200 ppm halothane 8 hr/d on days 8-12 of gestation	No gross teratologic effect reported	126
"	1,600 or 3,200 ppm halothane 8 hr/d on days 1-21 of gestation	Reduction in fetal weight and crown-rump length	126

TABLE XIII-16

GAS SAMPLING AND ANALYTICAL EQUIPMENT

Equipment	Capabilities	Manufacturer/ Approximate Cost
AIR MONITORING		
Miran I Gas Analyzer (infrared)	With single filter and 1 m sampling cell, for N_2O. Variable filter models and longer sampling cells are available with increasing versatility and sensitivity.	Wilks Scientific Corp., S. Norwalk, Conn. $3050
Miran 101 Specific Vapor Analyzer (infrared)	With single filter and 5.5 m sampling cell, for N_2O, and/or halogenated anesthetics	Wilks Scientific Corp., S. Norwalk, Conn. $2950
Sensors N_2O Monitor (prototype model) (infrared)	With single filter and 5 in. sampling cell; volume 30 cc for N_2O, including 100 cc samples	Sensors, Inc., Ann Arbor, Mich. $1500
Halogen Leak Detector	Modified for continuous monitoring (under development). Continuous monitoring for halogenated anesthetics	Inficon, Inc., E. Syracuse, N.Y. $1500
SAMPLING IN GAS-TIGHT BAGS		
Snout-Type Sample Bags	Various capacities, 2 to 44 L	Calibrated Instruments, Inc., Ardsley, N.Y. $6-$14
Aquarium Pump (Hush I)	Economical method for filling sampling bags	Metaframe Aquarium Products, Maywood, N.J. $5
Bleed Valve	Standard hardware item. Choose one with an O-ring seal	Available in pet shops $1
Flowmeter (Dwyer Series VF, 0.06 to 0.5 L/min)	---	Dwyer Instruments, Inc., Michigan City, Ind. $18
SYRINGE SAMPLING INCLUDING TRACE GAS ANALYSIS		
Complete Kit	Includes sampling syringe and mailing box. Single analysis, includes all gases	Boehringer Labs., Wynnewood, Penn. $35
LEAK DETECTORS		
Ferret Industrial Leak Detector (ionizing)	For halogenated anesthetics	General Electric Co., Lynne, Mass. $1250
Halogen Leak Detector (HLD-1) (ionizing)	For halogenated anesthetics	Inficon, Inc., E. Syracuse, N.Y. $1500
N_2O Leak Detector (ionizing)	For N_2O (under development)	Inficon, Inc., E. Syracuse, N.Y. $1500

Adapted from reference 159

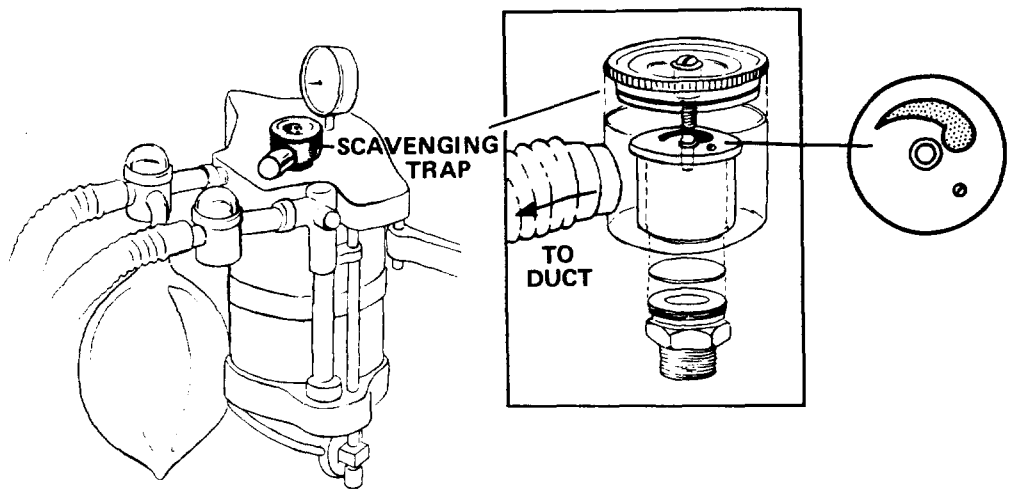


Figure XIII-1 DUPACO SCAVENGING POPOFF VALVE FOR CIRCLE ABSORBER

Adapted from reference 159

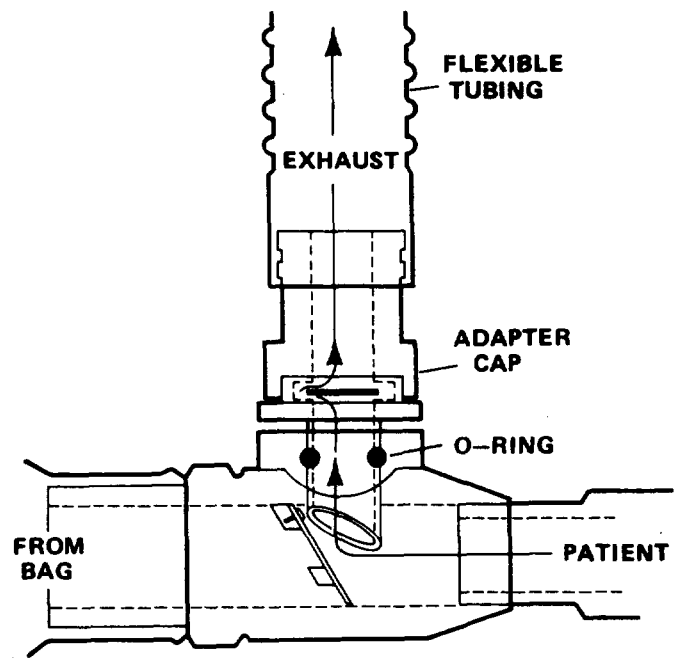


Figure XIII-2 WASTE GAS COLLECTOR FOR DUPACO NONREBREATHING VALVE

Effluent gases are captured by adapter cap.

Adapted from reference 159

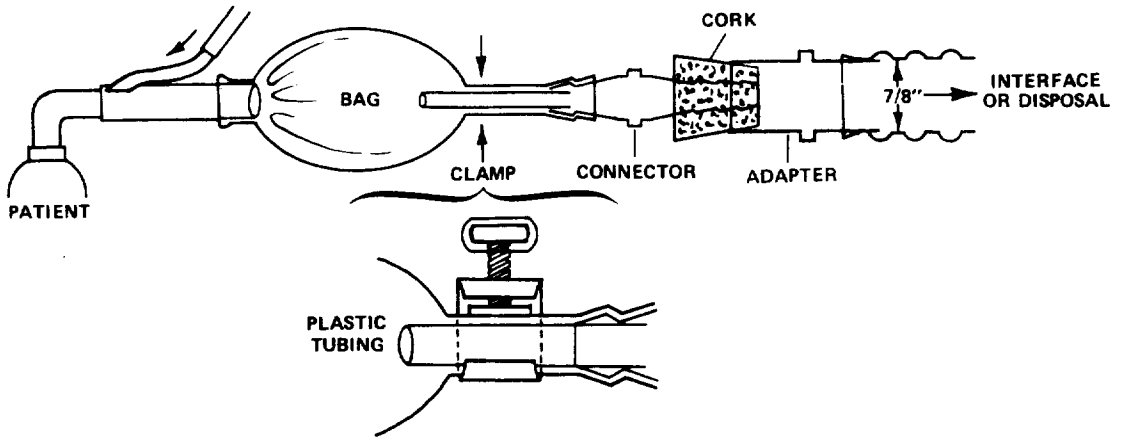


Figure XIII-3 WASTE GAS COLLECTOR FOR T-TUBE

Effluent gases are captured at tail of bag.

Adapted from reference 159

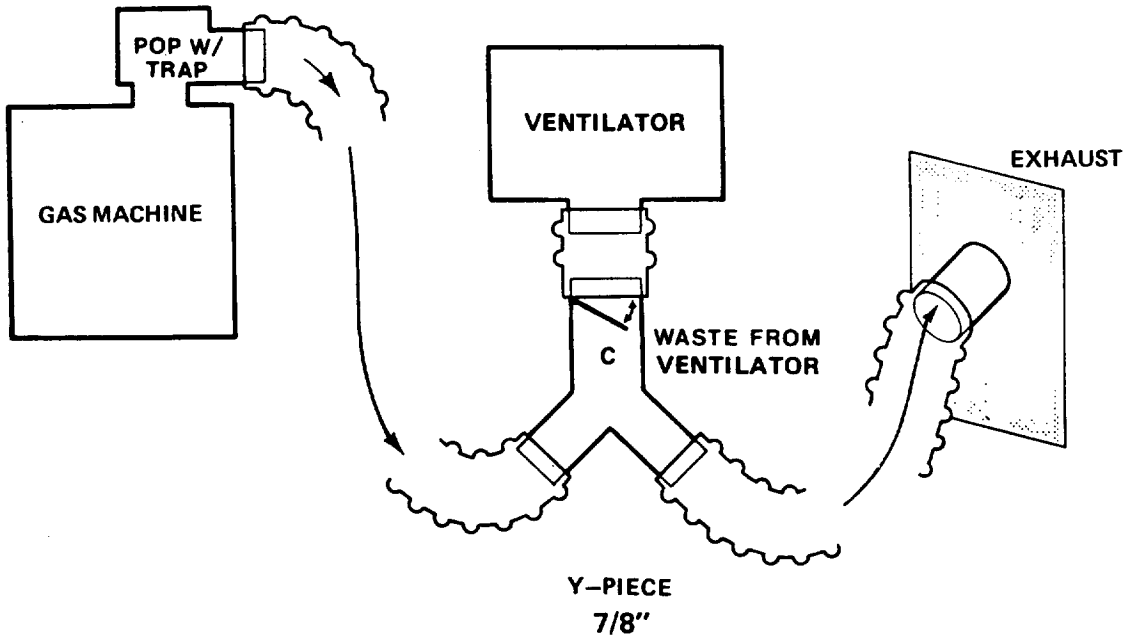


Figure XIII-4 USE OF A Y-PIECE TO COLLECT WASTE GAS FROM ABSORBER, VENTILATOR, AND CHECK VALVE (C) TO PREVENT LEAKAGE

Adapted from reference 159

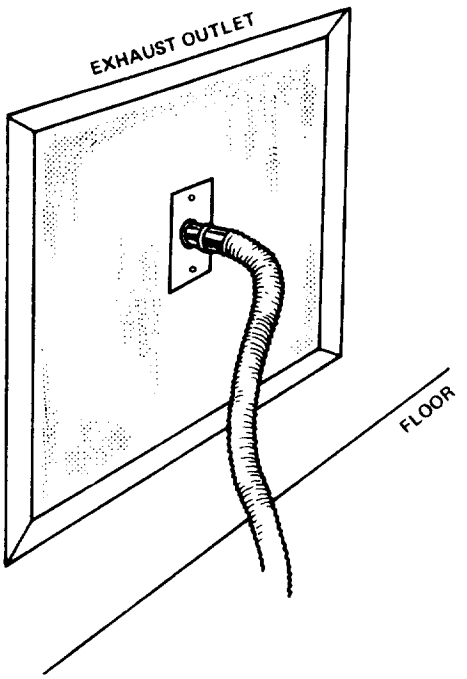


Figure XIII-5 WASTE GAS DISPOSAL INTO AIR-CONDITIONING EXHAUST SYSTEM LOCATED IN OPERATING ROOM

Adapted from reference 159

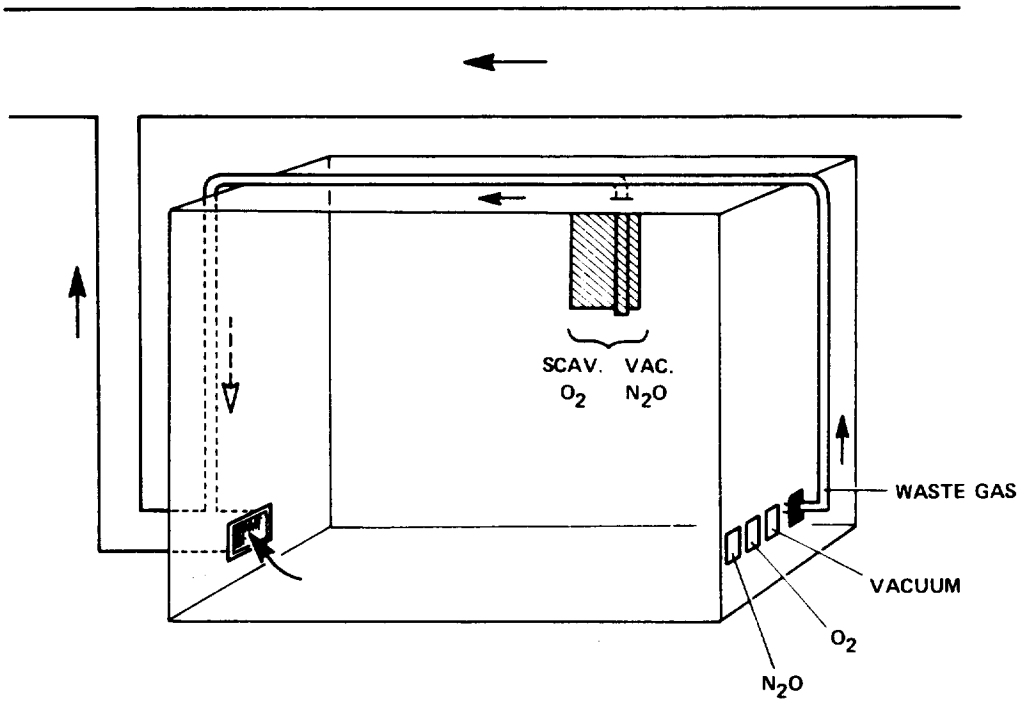


Figure XIII-6 CONCEALED ACCESS TO AIR-CONDITIONING EXHAUST

Adapted from reference 159

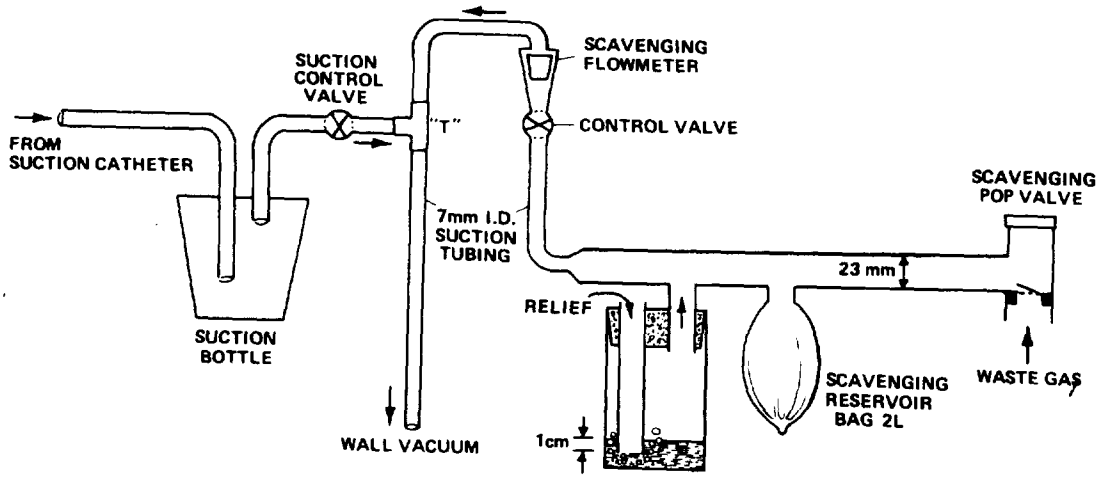


Figure XIII-7 DISPOSAL INTO WALL SUCTION - ONE OUTLET

Adapted from reference 159

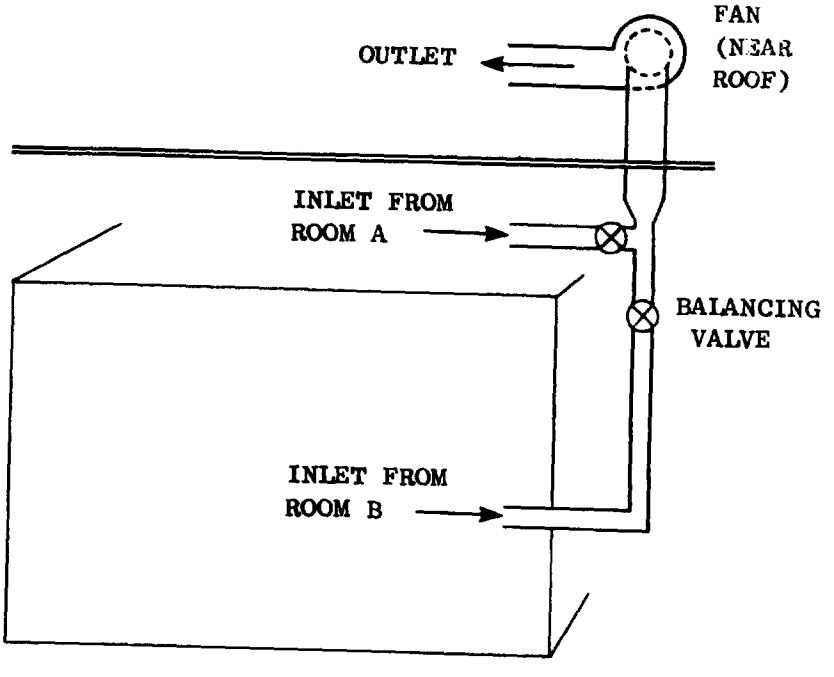
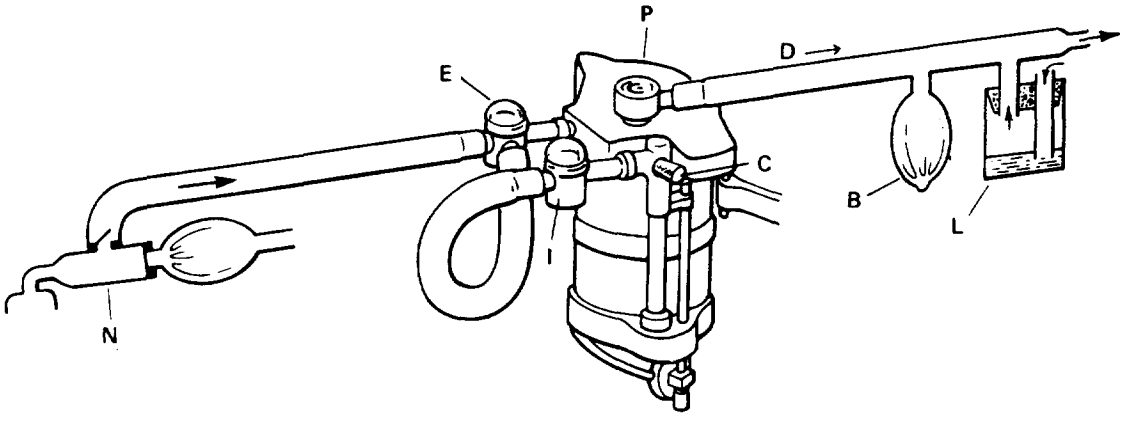


Figure XIII-8 LOW-VELOCITY DUCT SYSTEM FOR WASTE GAS DISPOSAL

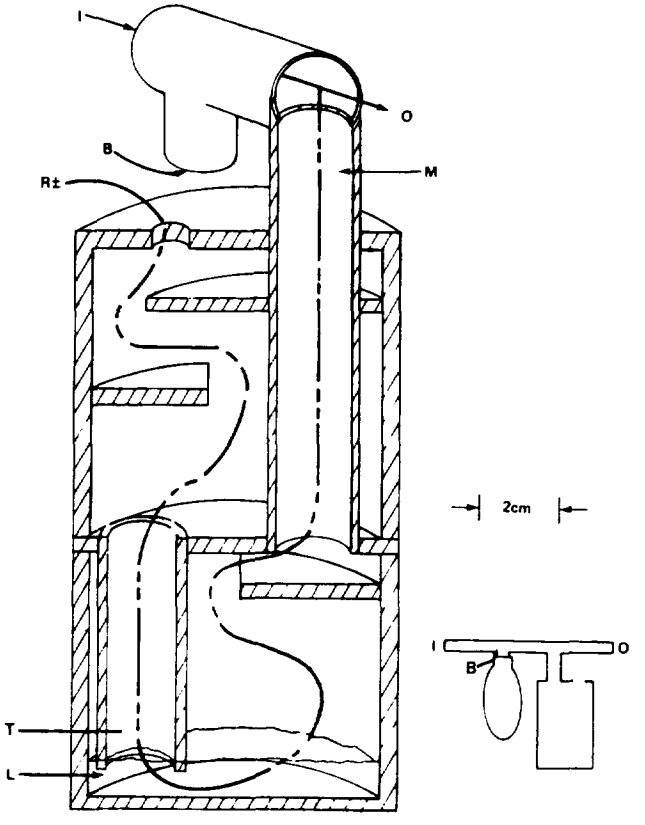
Adapted from reference 159



N = nonrebreathing valve
E = exhalation check valve
I = inhalation check valve
P = scavenging popoff valve
D = disposal tubing
C = occluded fresh gas inlet
B = scavenging reservoir bag
L = liquid-sealed interface device

Figure XIII-9 USE OF ABSORBER CIRCUIT FOR WASTE GAS DISPOSAL

Adapted from reference 159



I = inlet from breathing system

O = outlet to disposal system

M = manometer site for measurements

R± = positive/negative pressure relief opening

L = liquid level

B = scavenging reservoir bag

T = pressure limiting tube

Figure XIII-10 STANDFORD LIQUID SEALED PRESSURE LIMITING INTERFACE

Adapted from reference 159

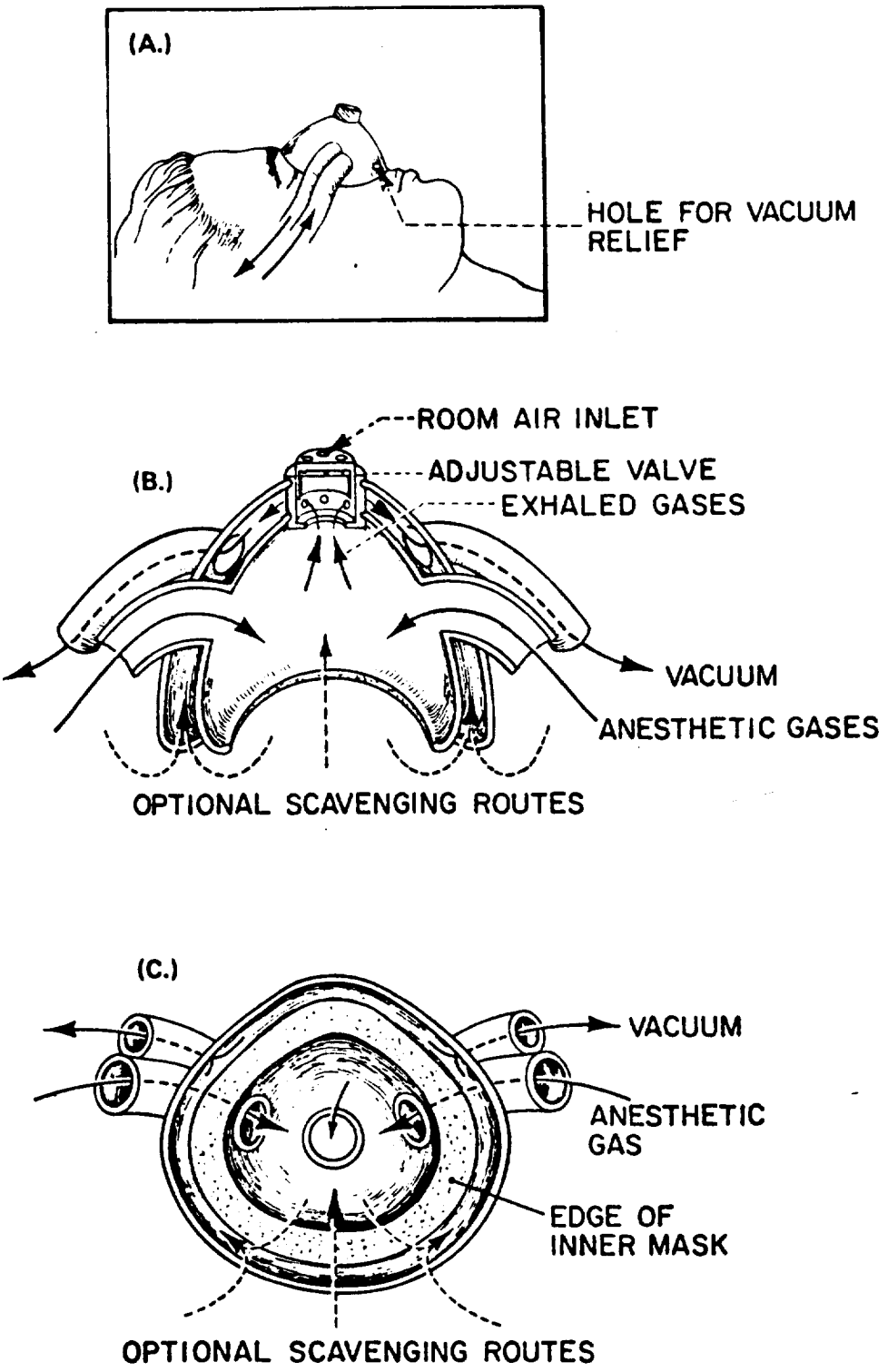


Figure XIII-11 NEWLY DEVELOPED SCAVENGING MASK

Double mask with suction in space between masks maintains low environmental concentrations of nitrous oxide.

Adapted from reference 172

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