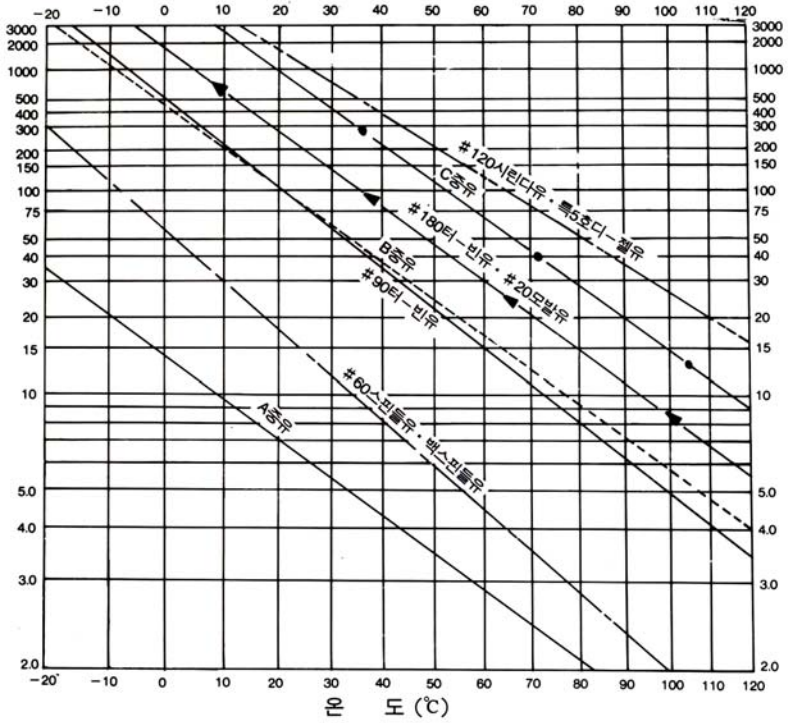
☞ 5. 점도표

1. 유체의 점도

• 기름의 온도와 점도곡선



공업용 점도단위의 환산

$\nu = \frac{\mu}{\rho}$

ν : 점도(stokes : St, centistokes : cSt)

μ : 절대점도(Poise : P, centipoise : cP)

ρ : 밀도(g/cm³)

1 Poise = 100centipoise

1 stokes = 100centistokes

• 점도의 환산표

센치스토크스 CST	세보르트(초) SSU (sec.)	렛드웃드 (No.1)초 R (sec.)	엔크라도 E (°)	센치스토크스 CST	세보르트초 SSU (sec.)	렛드웃드 (No.1)초 R (sec.)	엔크라도 E (°)
2.7	35	32.2	1.18	103	475	419	13.5
4.3	40	36.2	1.32	108	500	441	14.2
5.9	45	40.6	1.46	119	550	485	15.6
7.4	50	44.9	1.60	130	600	529	17.0
8.9	55	49.1	1.75	141	650	573	18.5
10.4	60	53.5	1.88	152	700	617	19.9
11.8	65	57.9	2.02	163	750	661	21.3
13.1	70	62.3	2.15	173	800	705	22.7
14.5	7	67.6	2.31	184	850	749	24.2
15.8	80	71.0	2.42	195	900	793	25.6
17.0	85	75.1	2.55	206	950	837	27.0
18.2	90	79.6	2.68	217	1000	882	28.4
19.4	95	84.2	2.81	260	1200	1058	34.1
20.6	100	88.4	2.95	302	1400	1234	39.8
23.0	110	97.1	3.21	347	1600	1411	45.5
25.0	120	105.9	3.49	390	1800	1587	51
27.5	130	114.8	3.77	433	2000	1763	57
29.8	140	123.6	4.04	542	2500	2204	71
32.1	150	132.4	4.32	650	3000	2646	85
34.3	160	141.1	4.59	758	3500	3087	99
36.5	170	150.0	4.88	867	4000	3516	114
38.8	180	158.8	5.15	974	4500	3967	128
41.0	190	167.5	5.44	1082	5000	4408	142
43.2	200	176.4	5.72	1150	5500	4849	156
47.5	220	194.0	6.28	1300	6000	5290	160
51.9	240	212	6.85	1400	6500	5730	185
56.5	260	229	7.38	1510	7000	6171	199
60.5	280	247	7.95	1630	7500	6612	213
64.9	300	265	8.51	1740	8000	7053	227
70.3	325	287	9.24	1850	8500	7494	242
75.8	350	309	9.95	1960	9000	7934	256
81.2	375	331	10.7	2070	9500	8375	270
86.8	400	353	11.4	2200	10000	8816	284
92.0	425	375	12.1				
97.4	450	397	12.8				

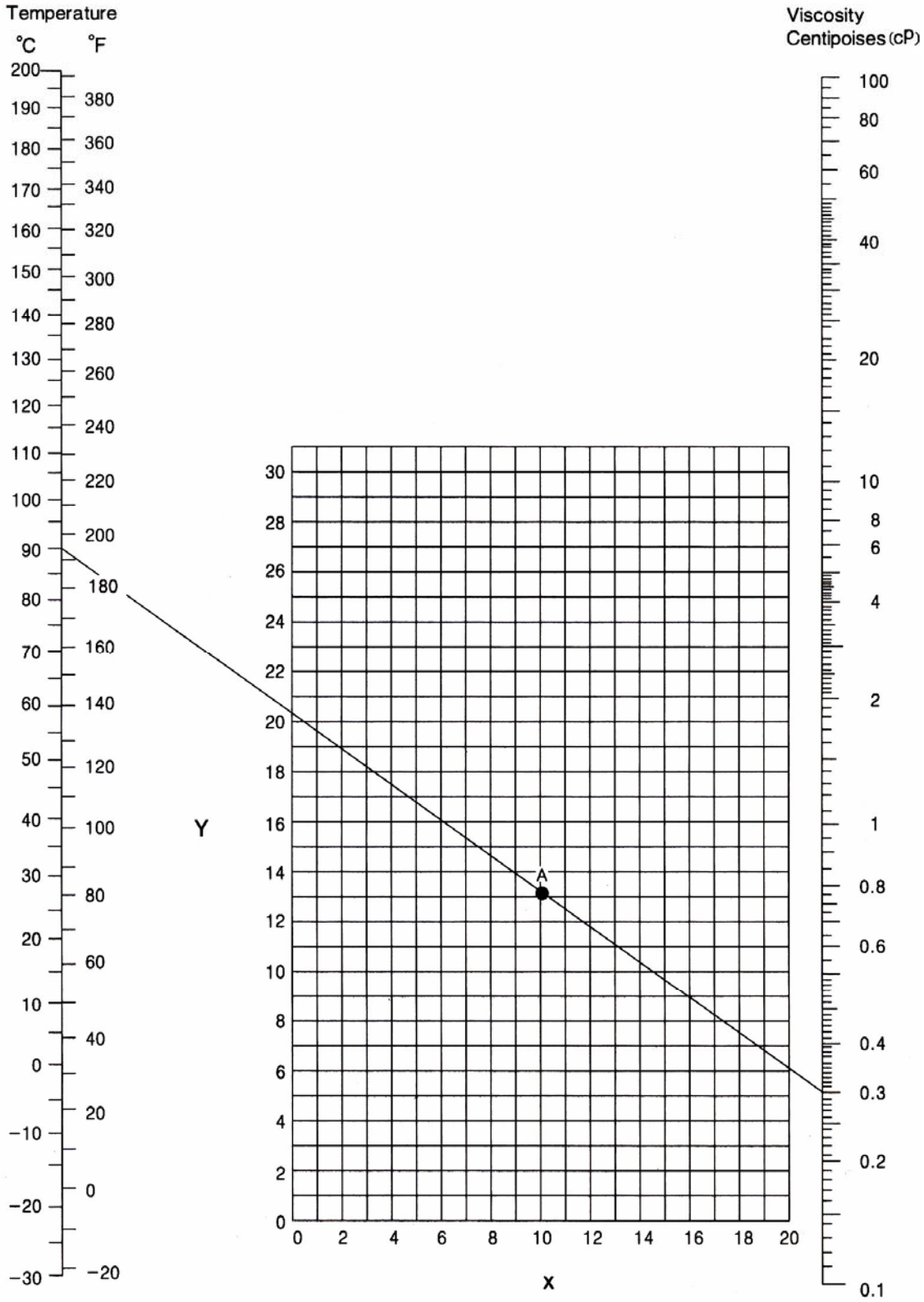
2. 액체의 점도 도표 (점도는 뒷페이지 참조)

No.	기체	FORMULA	X	Y	No.	기체	FORMULA	X	Y
1	Acetaldehyde	CH_3CHO	15.2	4.8	56	Freon-22	$CHClF_2$	17.2	4.7
2	Acetic acid, 100%	CH_3COOH	12.1	14.2	57	Freon-113		12.5	11.4
3	Acetic acid, 70%	CH_3COOH	9.5	17.0	58	Glycerol, 100%	$CH_2OHCHOHCH_2O$	2.0	30.0
4	Acetic anhydride	$(CH_3CO)_2O$	12.7	12.8	59	Glycerol, 50%	$CH_2OHCHOHCH_2O$	6.9	19.6
5	Acetone, 100%	CH_3COCH_3	14.5	7.2	60	Heptane	C_7H_{16}	14.1	8.4
6	Acetone, 35%	CH_3COCH_3	7.9	15.0	61	Hexane	C_6H_{14}	14.7	7.0
7	Allyl alcohol	$CH2CHCH_2OH$	10.2	14.3	62	Hydrochloric acid, 31.5%	HCl	13.0	16.6
8	Ammonia, 100%	NH_3	12.6	2.0	63	Isobutyl alcohol	C_4H_9OH	7.1	18.0
9	Ammonia, 26%	NH_3	10.1	13.9	64	Isobutyl acid		12.2	14.4
10	Amyl acetate		11.8	12.5	65	Isobutyric alcohol	$CH_3CH_2CH_2COOH$	8.2	16.0
11	Amyl alcohol	$C_5H_{12}O$	7.5	18.4	66	Kerosene		10.2	16.9
12	Aniline	C_6HoN	8.1	18.7	67	Linseed oil, raw		7.5	27.2
13	Anisole	$C_6H_5CH_3$	12.3	13.5	68	Mercury Hg		18.4	16.4
14	Arsenic trichloride	$ASCl_3$	13.9	14.5	69	Methanol, 100%	CH_3OH	12.4	10.5
15	Benzene	C6H66	12.5	10.9	70	Methanol, 90%	CH_3OH	12.3	11.8
16	Bimethyl oxalate	$(CH_3)_2C_2O_4$	12.3	15.8	71	Methanol, 40%	CH_3OH	7.8	15.5
17	Biphenyl	$C_{12}H_{10}$	12.0	18.3	72	Methyl acetate		14.2	8.2
18	Brine, CaCl2, 25%		6.6	15.9	73	Methyl chloride	CH_3Cl	15.0	3.8
19	Brine, NaCl, 25%		10.2	16.6	74	Methyl ethyl ketone	$CH_3COC_2H_5$	13.9	8.6
20	Bromine	Br	14.2	13.2	75	Naphthalene	$C_{10}H_8$	7.9	18.1
21	Bromotoluenex	Br	20.0	15.9	76	Nitric acid, 95%	HNO_3	12.8	13.8
22	Butyl acetate		12.3	11.0	77	Nitric acid, 60%	HNO_3	10.8	17.0
23	Butyl alcohol	C_4H_9OH	8.6	17.2	78	Nitrobenzene	$C_6H_5NO_2$	10.6	16.2
24	Butyric acid	$CH_3CH_2CH_2COOH$	12.1	15.3	79	Nitrotoluene	$C_6H_4(CH_3)NO_2$	11.0	17.0
25	Carbon dioxide	CO_2	11.6	0.3	80	Octane	$CH_3(CH_2)_6CH_3$	13.7	10.0
26	Carbon disulfide	CS_2	16.1	7.5	81	Octyl alcohol	$CH_3(CH_2)_6CH_2OH$	6.6	21.1
27	Carbon tetrachloride	CCL_4	12.7	13.4	82	Pentachloroethane	C_2HCl_5	10.9	17.3
28	Chlorobenzene	C_6H_5Cl	12.3	12.4	83	Pentane	$CH_3(CH_2)_3CH_3$	14.9	5.2
29	Chloroform	$CHCl_3$	14.4	10.2	84	Phenol	C_5H_6OH	6.9	20.8
30	Chlorosulfonic acid	$ClSO_3H$	11.2	18.1	85	Phosphorus tribromide	PBr_3	13.8	16.7
31	o-Chlorotoluene	C_7H_8Cl	13.0	13.1	86	Phosphorus trichloride	PCl_3	16.2	10.9
32	m-Chlorotoluene	C_7H_8Cl	13.3	12.5	87	Propionic acid	CH_3CH_2COOH	12.8	13.8
33	p-Chlorotoluene	C_7H_8Cl	13.3	12.5	88	Propyl alcohol	$CH_3(CH_2)_2OH$	9.1	16.5
34	m-resol		2.5	20.8	89	Propyl bromide	C_3H_7Br	14.5	9.6
35	Cyclohexanol	C6H10	2.9	24.3	90	Propyl chiaride	C_3H_7Cl	14.4	7.5
36	Dibromoethane	$C_2H_4Br_2$	12.7	15.8	91	Propyl iodide	C_3H_7I	14.1	11.6
37	Dichloroethane	$C_2H_4Cl_2$	13.2	12.2	92	Sodium Na		16.4	13.9
38	Dichloromethane	CH_2Cl_2	14.6	8.9	93	Sodium hydroxide, 50%	NaOH	3.2	25.8
39	Diethyl oxalate	$(C_2H_5)_2C_2O_4$	11.0	16.4	94	Stannic chloride	NaCl	13.5	12.8
40	Dipropyl oxalate	$(C_3H_7)_2C_2O_4$	10.3	17.7	95	Sulfur dioxide	SO_2	15.2	7.1
41	Ethyl acetate	$CH_3COOC_2H_5$	13.7	9.1	96	Sulfuric acid, 100%	H_2SO_4	7.2	27.4
42	Ethyl alcohol, 100%	C_2CH_5OH	10.5	13.8	97	Sulfuric acid, 98%	H_2SO_4	7.0	24.8
43	Ethyl alcohol, 95%	C_2CH_5OH	9.8	14.3	98	Sulfuric acid, 60%	H_2SO_4	10.2	21.3
44	Et hyl alcohol, 40%	C_2CH_5OH	6.5	16.6	99	Suluryl chloride		15.2	12.4
45	Ethyl benzene	$C_6H_5C_2H_5$	13.2	11.5	100	Tetrachloroethane	$C_2H_2Cl_4$	11.9	15.7
46	Ethyl bromide	CH_3CH_2Br	14.5	8.1	101	Tetrachloroethylene	CCl_2CCl_2	14.2	12.7
47	Ethyl chloride	CH_3CH_2Cl	14.8	6.0	102	Titanium tetrachloride	$TiCl_4$	14.4	12.3
48	Ethyl ether	$CH_3CH_2OCH_2CH_3$	14.5	5.3	103	Toluene	C_7H_8	13.7	10.4
49	Ethyl formate		14.2	8.4	104	Trichloroethylene	$CHClCCl_2$	14.8	10.5
50	Ethyl iodide	C_2H_5I	14.7	10.3	105	Turpentine		11.5	14.9
51	Ethylene glycol	$HO(CH_2)_2OHl$	6.0	23.6	106	Vinyl acetate		14.0	8.8
52	Formic acid	HCOOH	10.7	15.8	107	Water	H_2O	10.2	13.0
53	Freon-11	CCl_3F	14.4	9.0	108	o-Xylene	$C_6H_4(CH_3)_2$	13.5	12.1
54	Freon-12	CCl_2F_2	16.8	5.6	109	m-Xylene	$C_6H_4(CH_3)_2$	13.9	10.6
55	Freon-21	$CClF_2$	15.7	7.5	110	p-Xylene	$C_6H_4(CH_3)_2$	13.9	10.9

• 도표에서 점도를 찾는 방법

ex) 액체의 종류가 90℃ 물인 경우

1) 위 표에서 물의 좌표값을 찾는다. (X=10.2, Y+13.0)
2) X, Y 값을 그림의 좌표상에 표시한다. (A 점)
3) 왼쪽의 온도표의 90℃지점과 A 점을 연결한 그 연장선과 오른쪽 점도표와 만나는 점의 수치를 읽는다.
4) 따라서 90℃물의 점도는 0.3cP 이다.



3. 기체의 점도 도표 (점도는 뒷페이지 참조)

No.	기 체	Formula	X	Y	No.	기 체	Formula	X	Y
1	Acetic acid	CH_3COOH	7.7	14.6	29	Freon-113		11.3	14.0
2	Acetone	CH_3COCH_3	8.9	13.0	30	Helium	He	10.9	20.5
3	Acetylene	C_2H_2	9.8	14.9	31	Hexane	C_6H_{14}	8.6	11.8
4	Air		11.0	20.0	32	Hydrogen	H_2	11.2	12.4
5	Ammonia	NH_3	8.4	16.0	33	$3H_2+N_2$		11.2	17.2
6	Argon	Ar	10.5	22.4	34	Hydrogen bromide	HB_2	8.8	20.9
7	Benzene	C_3H_6	8.5	13.2	35	Hydrogen chloride	HCl	8.8	18.7
8	Bromine	Br	8.9	19.2	36	Hydrogen cyanide	HCN	9.8	14.9
9	Butane	C_4H_{10}	9.2	13.7	37	Hydrogen iodide	HI	9.0	21.3
10	Butylene	C_4H_8	8.9	13.0	38	Hydrogen sulfide	H_2S	8.6	18.0
11	Carbon dioxide	CS_2	9.5	18.7	39	Iodine	I	9.0	18.4
12	Carbon disulfide	CO	8.0	16.0	40	Mercury	Hg	5.3	22.9
13	Carbon monoxide	Cl	11.0	20.0	41	Methane	CH_4	9.9	15.5
14	Chlorine	$CHCl_3$	9.0	18.4	42	Methyl alcohol	CH_3OH	8.5	15.6
15	Chloroform	$CHCl_3$	8.9	15.7	43	Nitrogen oxide	NO	10.9	20.5
16	Cyanogens		9.2	15.2	44	Nitrogen	N_2	10.6	20.0
17	Cyclohexane	C_6H_{12}	9.2	12.0	45	Nitrosyl chloride	NOCl	8.0	17.6
18	Ethane	C_2H_6	9.1	14.5	46	Nitrous Oxide	N_2O	8.8	19.0
19	Ethyl acetate	$CH_3CooC_2H_5$	8.5	13.2	47	Oxygen	O_2	11.0	21.3
20	Ethyl alcohol	C_2H_5OH	9.2	14.2	48	Pentane	$CH_3(CH_2)_3CH_3$	7.0	12.8
21	Ethyl chloride	CH_3CH_2Cl	8.5	15.6	49	Propane	$CH_3CH_2CH_3$	9.7	12.9
22	Ethyl ether	$CH_3CH_2OCH_2CHP_3$	8.9	13.0	50	Propyl alcohol	$CH_3CH_2CH_2OH$	8.4	13.4
23	Ethylene	CH_2CH_2	9.5	15.1	51	Propylene	CH_3HCH_3	9.0	13.8
24	Fluorine	F	7.3	23.8	52	Sulfur dioxide	SO_2	9.6	17.0
25	Freon-11	CCl_3F	10.6	15.1	53	Toluene	$C_5H_5CH_3$	8.6	12.4
26	Freon-12	CCl_2F_2	11.1	16.0	54	2,3,3-Trimethylbutane		9.5	10.5
27	Freon-21	CClF3	10.8	15.3	55	Water	H_2O	8.0	16.0
28	Freon-22	$CHCLF_2$	10.1	17.0	56	Xenon	Xe	9.3	23.0

• 도표를 보면서 점도를 찾는 방법

예) 기체의 종류가 20℃ Air인 경우
1) 위 표에서 Air의 좌표 값을 찾는다. (X=11.0, Y=20.0)
2) X, Y값을 옆의 좌상 표에 표시한다. (A점)
3) 왼쪽의 온도표의 20℃지점과 A점을 연결한 그 연장선과 오른쪽 점도 표와 만나는 점의 수치를 읽는다.
4) 따라서 20℃ Air의 점도는 0.018cP이다.

• cP를 cSt로 바꾸는 방법 (기체의 cP / 기체의 밀도 (g/cm²) = 기체의 cSt)

예) 20℃ Air의 점도 0.018cP를 cSt로 바꿀 때 (Air의 밀도: 1.20×10^{-3} g/cm^2)
$0.018cP/1.20\times10^{-3}$ (g/cm^2)=15.1cSt