PUMP CALCULATION SHEET

(RECIPROCATING METERING PUMP)

( )

CLIENT :

PROJECT

TITLE :

JOB NO. :

DOC. NO. : ( )

REV.	1	2	3	MADE	
BY				CHKD	
CHKD				APVD	
APVD					
DATE				DATE	

ITEM NO. :

SERVICES :

FLUID					Symbol	Note	
PUMPED LIQUID		WATER					
OPERATING TEMPERATURE	^{O}C	90				Data	
VISCOSITY AT OPERERATING TEMP.	cP	0.23			VIS	Data	
VAPOR PRESSURE	kg/cm^2A	0.15			PV	Data	
SP. GR. AT OPERATING TEMP.		0.99			SG	Data	
GRAVITY	m/s^2	9.81			g	Data	
CAPACITY	m^3/hr	**120**			Q	Data	
EXCESS CAPACITY	%	0			Qe%		
MAX. CAPACITY	m^3/hr	120			Q'	Q' = 0.01 Q (100+Qe%)	
VOLUMETIRIC EFFICIENCY	%	94			η_V	Page 7	
PLUNGER DISPLACEMENT CAPACITY	m^3/hr	127.7			Qp1	Qp1 = 100 Q /η_V	
ESTIMATED STROKE LENGTH	mm	152			L	Fig. 10, 9, app. A	*z=3 triplex, L = 152 mm*
EST'D SPEED	RPM	360			N		*N=360 rpm*
EST'D PLUNGER DIA.	mm	133				Eq. 13 or Appendix A	
NUMBER OF PLUNGER		3			z		
SUCTION PIPE DIA. AND DISCHARGE	mm	194	/	146	Dps, Dpd	Appendix A	
SUCTION PIPE LENGTH and DISCHARGE	m	9	/	50	Lps, Lpd	Data	
SUCTION							
PRESSURE AT EQUIPMENT	kg/cm^2A	**3**			P1	Data	
MIN. STATIC HEAD (+ or -)	m	1			H1	Data (minus if bellow pump elevation)	
PIPE FRICTION	kg/cm^2	0.12				Data	*See note 1)*
PRESS. DROP AT EQUIPMENT(.....)	kg/cm^2	0.05				Data	*See note 1)*
SUCTION PUMP DIA.	mm	146			ID	App. A	
VELOCITY HEAD AT SUCTION	kg/cm^2	0.020			HV	Eq. 1 and 2	*See note 1)*
SUCTION HEAD	kg/cm^2	-0.091			DPt1	= 0.1 SG.H1 - Loss in line 25&26 - HV	
PUMP SUCTION PRESSURE	kg/cm^2A	**2.909**			PS	Eq. 1 to 3	
NPSH AVAILABLE	m	27.868			NPSHA	Eq. 8	
DISCHARGE							
PRESSURE AT EQUIPMENT	kg/cm^2A	12			P2	Data	
STATIC HEAD	m	24			H2	Data	
PRESSURE DROP AT :							
PIPE (include fittings & valves)	kg/cm^2	0.12				Data	
Equipment 1 (.....	kg/cm^2	0.11				Data	*See note 1)*
Equipment 2(.....	kg/cm^2	0.1				Data	
Equipment 3 (.....	kg/cm^2	0.05				Data	
DISCHARGE PRESSURE DROP	kg/cm^2	0.380			DP2	= total of line no. 36 up to 39	
DISCHARGE HEAD	kg/cm^2	3.136			DPt2	= DP2 + 0.1(H2)(SG)	
ORIFICE PRESS. DROP RATIO	%	20			η_P	If require pulsation dampener. If not fill with 0	
ORIFICE PRESS. DROP	kg/cm^2	0.627			DP_{OR}	Eq. 18	
ACCELERATION HEAD	kg/cm^2	0.000				If does not require pulsation dampener use eq. 15	
PUMP DISCHARGE PRESSURE	kg/cm^2A	18.139			PD	PD = P2+0.1(H2)(SG)+DP2	
PUMP SUCTION PRESSURE	kg/cm^2A	2.909			PS	= line 22	
PUMP DIFF. PRESSURE	kg/cm^2	15.230			DP	DP=PD-PS	
TOTAL HEAD (CALCULATED)	m	153.84			H	H=10(DP)/SG	
TOTAL HEAD (TAKE)	m	154.00			H		
MECHANICAL EFFICIENCY	%	88			η_M	Page 7	
GEAR EFFICIENCY	%	93			η_{GEAR}	Page 7	
LIQUID HORSE POWER	kW	59.21			LHP	Eq. 9 and 10	
PUMP BHP	kW	71.57			BHP_{PUMP}	Eq. 11	
DRIVER BHP	kW	76.96			BHP_{DRIVER}	Eq. 12	
ESTIMATED NPSH R	m	21.83			NPSHR	Eq. 20	
MINIMUM SUCTION EQP. PRESS.	kg/cm^2A	2.40			$P1_{MIN}$	=0.1 NPSHR.SG + PV - DPt1	

NOTES : 1) THIS PRESSURE DROP SHALL HAS BEEN MULTIPLIED FROM CONTINOUS FLOW PRESS. DROP CALCULATION BY

10 times for simplex

2.6 times for duplex *Note 2). Pulsation dampener vol. = (25 Lt x 18/11.2)/22 = 1.8 Lt*

1.2 times for triplex *Value of 25 Lt provided from fig. 13*

PUMP CALCULATION SHEET

(RECIPROCATING METERING PUMP)

( )

CLIENT :

PROJECT

TITLE :

JOB NO. :

DOC. NO. : ( )

REV.	1	2	3	MADE	
BY				CHKD	
CHKD				APVD	
APVD					
DATE				DATE	

ITEM NO. :

SERVICES :

FLUID		Preliminary	Recalculation	Note
PUMPED LIQUID		Hydrazine		
OPERATING TEMPERATURE	^{o}C	32		Data
VISCOSITY AT OPERERATING TEMP.	cP	0.23		Data
VAPOR PRESSURE	kg/cm^2A	0.45		Data
SP. GR. AT OPERATING TEMP.		0.98		Data
GRAVITY	m/s^2	9.81		Data
CAPACITY	m^3/hr	**0.32**		Data
EXCESS CAPACITY	%	0		
MAX. CAPACITY	m^3/hr	0.32		Q' = 0.01 Q (100+Qe%) 5 lt/min
VOLUMETIRIC EFFICIENCY	%	94		Page 7
PLUNGER DISPLACEMENT CAPACITY	m^3/hr	0.34		Qp1 = 100 Q /η_V
ESTIMATED STROKE LENGTH	mm	35		Fig. 10, 9, app. A *z=3 triplex, L = 80 mm*
EST'D SPEED	RPM	160		*N=130 rpm*
EST'D PLUNGER DIA.	mm	20		Eq. 13 or Appendix A
NUMBER OF PLUNGER		3		
SUCTION PIPE DIA. AND DISCHARGE	mm	19 / 19		Appendix A
SUCTION PIPE LENGTH and DISCHARGE	m	8 / 25		Data
SUCTION				
PRESSURE AT EQUIPMENT	kg/cm^2A	**1.013**		Data
MIN. STATIC HEAD (+ or -)	m	2		Data (minus if bellow pump elevation)
PIPE FRICTION	kg/cm^2	0.05		Data *See note 1)*
PRESS. DROP AT EQUIPMENT(.....)	kg/cm^2	0		Data *See note 1)*
SUCTION PUMP DIA.	mm	19		App. A
VELOCITY HEAD AT SUCTION	kg/cm^2	0.0005		Eq. 1 and 2 *See note 1)*
SUCTION HEAD	kg/cm^2	0.146		= 0.1 SG.H1 - Loss in line 25&26 - HV
PUMP SUCTION PRESSURE	kg/cm^2A	**1.159**		Eq. 1 to 3
NPSH AVAILABLE	m	7.230		Eq. 8
DISCHARGE				
PRESSURE AT EQUIPMENT	kg/cm^2A	24		Data
STATIC HEAD	m	12		Data
PRESSURE DROP AT :				
PIPE (include fittings & valves)	kg/cm^2	0.1		Data
Equipment 1 (.....	kg/cm^2	0.06		Data *See note 1)*
Equipment 2(.....	kg/cm^2	0		Data
Equipment 3 (.....	kg/cm^2	0		Data
DISCHARGE PRESSURE DROP	kg/cm^2	0.160		= total of line no. 36 up to 39
DISCHARGE HEAD	kg/cm^2	1.496		= DP2 + 0.1(H2)(SG)
ORIFICE PRESS. DROP RATIO	%	20		If require pulsation dampener. If not fill with 0
ORIFICE PRESS. DROP	kg/cm^2	0.299		Eq. 18
ACCELERATION HEAD	kg/cm^2	0.00		If does not require pulsation dampener use eq. 15
PUMP DISCHARGE PRESSURE	kg/cm^2A	26.971		PD = P2+0.1(H2)(SG)+DP2
PUMP SUCTION PRESSURE	kg/cm^2A	1.159		= line 22
PUMP DIFF. PRESSURE	kg/cm^2	25.813		DP=PD-PS
TOTAL HEAD (CALCULATED)	m	263.39		H=10(DP)/SG
TOTAL HEAD (TAKE)	m	264.00		
MECHANICAL EFFICIENCY	%	88		Page 7
GEAR EFFICIENCY	%	93		Page 7
LIQUID HORSE POWER	kW	0.23		Eq. 9 and 10
PUMP BHP	kW	0.28		Eq. 11
DRIVER BHP	kW	0.31		Eq. 12
ESTIMATED NPSH R	m	2.99		Eq. 20
MINIMUM SUCTION EQP. PRESS.	kg/cm^2A	0.59		=0.1 NPSHR.SG + PV - DPt1
IS NPSHA IS ADEQUATE ?		**YES**		*See note 2)*

NOTES : *1) This value shall has been multiplied from continous flow pressure drop calculation by :*

10 times for simplex

2.6 times for duplex

1.2 times for triplex *Note 3) Pulsation dampener vol. = (9 Lt x 5/11.2)/22 = 0.6 Lt*