Monsanto COMPANY

LOCATION beside 429

CENTRIFUGAL PUMP PERFORMANCE DATA

PROJ/DEPT 811.00

EQUIP. IDENT NO. 431
AUTH NO. 1800 PLANT WGK
BY L. L. Lohman DATE 11-20-67
APPD RS.Y SHEET 1 OF 2

NAME Transfer Pump NO. REQD

FUNCTION Pump received Aroclor 1121 to the Biphenyl charge tank (It. 103) and pump sample surge tank (It. 435) to off-gas storage tank (It.)

OPERATION Batch Transfer of received Aroclor to batch Biphenyl charge tank; Batch transfer of sample reservoir to off-gas storage tank.

DUTY: [X] INTERMITTENT [ ] CONTINUOUS HOURS PER YEAR

MATERIALS HANDLED

	COMPONENT	UNITS	NORMAL	DESIGN	REMARKS
LIQUID	Aroclor 1121	gal/min		100	
	TOTAL				
SOLIDS	—				
GAS	—				

PROCESS DATA

PUMPING TEMPERATURE, PT, °F 122 | SP GR @ PT 1.15 @ 60 F .96 | CRYSTALLIZING, TEMP °F < 50°

VISCOSITY, Cp (UNITS) @ PT 3.8 @ 60 F 10

VAPOR PRESSURE, PSIA, @ PT .2 @ 60 F neg. | SOLIDS — % WT | DENSITY — | SIZE —

CORROSION/EROSION: [ ] NEGLIGIBLE [X] MODERATE [ ] SEVERE

ESTIMATED PERFORMANCE REQUIREMENTS

CAPACITY, USGPM: NORMAL 80 ; MAX DESIGN 100 ; CONTROL ALLOWANCE*

PUMP RATED CAPACITY (MAXIMUM DESIGN CAPACITY PLUS CONTROL ALLOWANCE), USGPM, 100

STATIC HEAD @ PT, 35 FT 15 PSI | EQUIPMENT LOSS, PSI: — NORMAL — RATED

PIPE DIA, NPS: SUCTION 3" ; DISCHARGE 2" | PIPING LOSS, PSI: 8.0 NORMAL RATED

CONTROL VALVE PRESSURE DROP, PSI: — NORMAL | AVAILABLE NPSH, FT: 33.5 NORMAL RATED

RATED TDH @ PT: 42 FT 21 PSI FROM PUMP CALCULATION SHEET NO. ES 95 (1/65)

SYSTEM CURVE CALCULATIONS FROM SHEET NO. ; DRIVER [X] ELEC MOTOR [ ] TURBINE [ ] OTHER

PUMP DATA

MATERIALS OF CONSTRUCTION:

CASING AND NOZZLES	Ductile iron	~~PACKING~~ "Woods" spacer type coupling	
IMPELLER	Ductile iron	MECHANICAL SEAL	John Crane QP191
SHAFT, SHAFT SLEEVE	DC8	PACKING GLAND	Yes
~~JOINERS~~ Bearings: Sealed for life		BASE PLATE	To accomodate 10 hp. motor
Coupling Guard Spec. D11.8 std 2001			Spec. D14.12 std 10

CONSTRUCTION FEATURES REQUIRED FOR PROCESS OR PERFORMANCE CONSIDERATIONS:

1. Use W.G.K. std pump Duriron Mk II.
2. Use W.G.K. std motor supplier - Lincoln
3. Base plate to be paint with spec. K1.3 std 604
4. Jacketed cover plate and stuffing box.

REMARKS, SPECS, TESTS, ETC.

Pump: Durco Mark II
3×1½-10 AVS A50 1750rpm

Motor: Non Overloading
Start-stop at Biphenyl
charge tank Item 103

*Capacity in excess of maximum design for control purposes.

REV NO.	REVISION	BY	DATE	APPD	DATE
1					
2					
3					

ES 55 (7/67)

Monsanto COMPANY

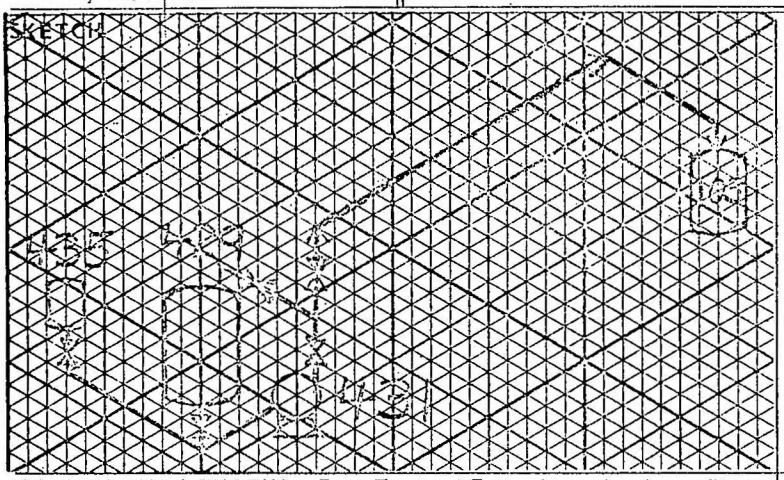
LOCATION beside 429

CENTRIFUGAL PUMP CALCULATION SHEET

PROJ/DEPT 911.00
PLANT W. G. K.

EQUIP. NO. 431
AUTH NO. 1800 AREA NO. 1
BY L. L. Lohman DATE 11-30-67
APPD R.S.Y. SHEET 2 OF 2

SKETCH



CONDITIONS

Material Pumped Aroclor 1221
P.T. = Pumping Temperature 50 °C 122 °F
gpm = Flow Rate: Normal 80 Design 100
S = Specific Gravity* 1.15 Density 8.2 lb/gal
μ = Viscosity* 37.55 u. 3.8 Centipoise
P_{vp} = Vapor Pressure* < 10. mmHg .2 psia
ΔP: Control Valve — psi; Equip. — psi
Pipe (Material Carbon steel Sch or Wall Thk 40)
Nominal Size 3" Suction 2" Discharge
d, Actual ID, inches 3.068 Suction 2.067 Discharge
*At Pumping Temperature

EQUIVALENT LENGTHS

Enter Type and Factor for each valve or fitting. Enter Number of each type, and line size. Multiply Factor × Size × Number and enter Feet equivalent length. See handbook for types not listed.

Factors for Valves (open) and Fittings					
Gate	1.1	Plug Valve	1.5	90° l. r. or Weld ell	1.7
Globe, Lift Check	28.0	Butterfly (6" & up)	1.7	Std Tee (on run)	1.7
Wye, Angle, Diaphr	14.0	90° Std Elbow	2.5	Std Tee (side out)	5.0
Swing Check	11.0	45° Std Elbow	1.3		

Suction					Discharge				
Type	Factor	Nominal Size, In.	Number	Feet	Type	Factor	Nominal Size, In.	Number	Feet
Pl. V.	1.5	2	1	4.5	Pl. V.	1.5	2	2	6
std Tr	1.7		1	5.1	std Tr	1.7		1	3.4
std Ts	5.0		1	15	90° rl.	1.7		4	13.6
Length of straight pipe in feet				10					100
L = Total Equivalent Length, feet				30					123

FRICTION HEAD LOSS

	Suction	Discharge
$V = (0.408)\ gpm/d^2$, feet per second	5.66	13.0
Re (Reynolds Number) = $(3162)\ gpmS/d\mu$	24 100	39 600
f = Friction Factor (See Appendix C of D14.2 Std 2) if Re < 2100 omit this step.	.028	.026
Δh [(Re < 2100) = $0.154\ \mu V/d^2 S$; (Re > 2100) = $18.63\ fV^2/d$] feet of fluid per 100 feet equivalent length	4.28	7.19
Total Friction Head Loss = $\Delta h \times L/100 \times 1.15$ (safety factor), feet of fluid	1.35	10.15

SUCTION AND DISCHARGE HEADS

	Suction	Discharge
Vessel Pressure (psia × 2.31/*S*)	(+) 39.2	(+) 39.2
Liquid Level (above pump +; below pump −)	( ) 2.0	
Static Head (above pump +; below pump −)		(+) 35.0
Total Friction Head Loss (Plus Velocity Head. See Note 4.)	(−) 1.4	(+) 10.2
Control Valve (Δpsi × 2.31/*S*) (See Notes 1 and 2)	(−) —	(+) —
Orifice (Δpsi × 2.31/*S*) (See Note 2)	(−) —	(+) —
Equipment (Δpsi × 2.31/*S*)	(−) —	(+) —
Suction Head Sum, feet of fluid, abs.	42.6	
Discharge Head Sum, feet of fluid, abs.		94.4

SYSTEM HORSEPOWER (estimated)

$$HP = \frac{gpm \times TDH \times S}{3960 \times E \text{ (Note 3)}}$$

$$HP = \frac{100 \times 42 \times 1.15}{3960 \times .40}$$

$$HP = 3.05$$

DYNAMIC HEAD

Discharge Head Sum 94.4
Suction Head Sum − 42.6
TDH = Total Dynamic Head, feet of fluid 41.8

NPSH

Suction Head Sum 42.6
P_{vp} (mmHg × 0.045/*S*) or (psia × 2.31/*S*) − .5
NPSH Available, feet of fluid, abs. 42.1

PUMP SELECTION

Manufacturer Duriron Co.; Model MK JT A50; Type 3×1½-10;
Speed 1750 rpm; Imp Size 8½"; HP 5; Eff .45;
GPM 100; TDH 50; NPSH 5

NOTES

1. Assume control valve loss to be 70% to 100% of piping plus equipment friction loss for initial calculation. Consult instrument engineer for final selection.
2. Control valves and orifices not normally used in pump suction.
3. Use combined efficiency of pump and drive.
4. See D14.2 STD 2, a guide for the use of this calculation procedure.

REV. NO.	REVISION	BY	DATE	APPD	DATE
1					
2					
3					

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