Advanced Pumping Systems

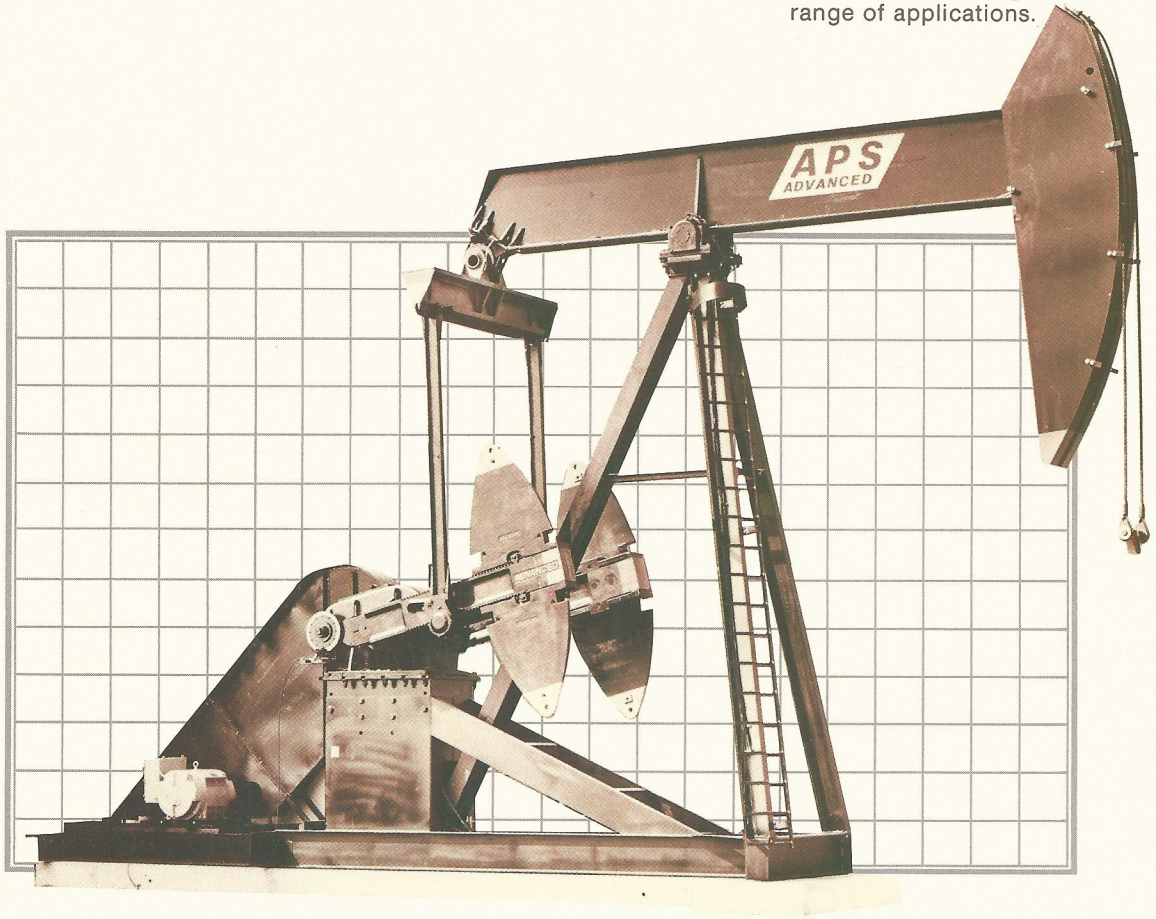
SYSTEM DESCRIPTION

The APS ADVANCED™ Universal Pumping System

The APS ADVANCED unit is the first universal crank-balanced pumping unit ever introduced.

Two APS ADVANCED universal structures handle a full range of requirements which previously required over 35 different API sized conventional units.

The APS ADVANCED universal units have been computer designed for absolute minimum gear reducer and prime mover requirements throughout the full range of applications.



Features:

- **UNIVERSAL DESIGN** — Two APS structures cover 114 through 912 applications.
- **GEAR REDUCER INTERCHANGEABILITY** — Each APS structure accommodates four interchangeable herringbone gear reducer sizes.
- **FULLY ADJUSTABLE STROKE** — Each APS structure allows continuous stroke adjustment over a range nearly double that of ordinary crank-balanced units.
- **OPTIMUM SYSTEM EFFICIENCY** — Each APS structure has a typical torque reduction of 35% compared to ordinary units.
- **LOWER SUCKER ROD STRESS** — The softer APS upstroke motion maximizes sucker rod life.
- **GEAR REDUCER LOAD REVERSALS MINIMIZED** — The smoother APS load curve results in longer reducer life, as load reversals have been essentially eliminated.
- **COUNTERBALANCING SIMPLE AND PRECISE** — Only one type of master and auxiliary weight is required for all 114 through 912 applications.
- **MINIMUM OPERATIONAL COSTS** — Energy savings can recover initial pumping unit investment within 3 years.
- **INVENTORY LOGISTICS MINIMAL** — The APS universal design reduces inventory requirements to an absolute minimum.
- **COMPETITIVE PRICE** — The APS universal design and commonality of tooling provide substantial overdesign at competitive prices.
- **COMPUTER SERVICE AVAILABLE** — Each customer application can be computer modeled by APS.
- **LABORATORY AND FIELD TESTING** — Complete structural performance can be verified on the state-of-the-art APS laboratory well simulator and the on-site systems analyzer.

UNIT DESIGNATIONS

THE ADVANCED 365-168 UNIVERSAL PUMPING UNIT *

4 Interchangeable Gear Reducers; 36,500# Structural Capacity; Any Stroke from 88" to 168"

THE ADVANCED 305-100 UNIVERSAL PUMPING UNIT *

4 Interchangeable Gear Reducers; 30,500# Structural Capacity; Any Stroke from 52" to 100"

* Basic Structure Includes: T-base, universal prime mover base, universal belt guard, wireline and carrier bar, brake assembly, safety ladder, ground oiling system, oil in reducer, required gear reducer and reducer sheave. Counterbalance weights are separately ordered according to the enclosed counterbalance effect charts. Consult APS for wide bases, custom prime mover mounting interfaces, crank guards and other accessories.

GEAR REDUCER SPECIFICATIONS

Authorization API #3924

All reducers are double reduction herringbone and feature split housings with bearing carriers for maintenance serviceability. Gear reducers are manufactured to APS specifications by Curtis Machine Company of Dodge City, Kansas.

	Reducer Size	Peak Torque Rating	Maximum Sheave	Sheave Bore	Gear Ratio
APS MODEL 365-168	912	912,000 in-lb	58" P.D.	3.875"	30.412
	640	640,000 in-lb	58" P.D.	3.875"	30.412
	456	456,000 in-lb	44" P.D.	3.000"	29.975
	320	320,000 in-lb	44" P.D.	3.000"	29.975
APS MODEL 305-100	320	320,000 in-lb	44" P.D.	3.000"	29.975
	228	228,000 in-lb	36" P.D.	2.500"	29.816
	160	160,000 in-lb	36" P.D.	2.500"	29.816
	114	114,000 in-lb	36" P.D.	2.500"	29.816

COMPONENT DESCRIPTIONS

APS has applied for patents on the universal linkage, the universal crank assembly and several universal subsystem components.

All structural bearings are self-aligning spherical bearings. The saddle assembly and the horsehead are adjustable for simple alignment. The crank pin can be continuously adjusted along a vernier scale for **any** exact stroke length required within the range of each unit. The universal crank weights are easily adjusted and locked for **any** precise counterbalance effect required.

APS MODEL 365-168

(PHASE ANGLE τ = -12.5°)

COUNTERBALANCE EFFECT AT θ = 90° CRANK ANGLE

WEIGHT COMPLEMENT*	TOTAL WEIGHT ADDED	MAXIMUM MOMENT, M (OCCURS AT θ =102.5°)	88"	92"	96"	100"	104"	108"	112"	116"	120"	124"	128"	132"	136"	140"	144"	148"	152"	156"	160"	164"	168"
			NOTE: STRUCTURAL UNBALANCE IS ZERO FOR ALL STROKES																				
Cranks Only	0	283460	6675	6399	6146	5915	5701	5505	5323	5154	4997	4851	4715	4588	4469	4358	4254	4157	4065	3980	3899	3824	3753
2MW	2000	440960 - (2000 x ΔR)	10384	9955	9562	9201	8870	8563	8280	8018	7774	7547	7335	7138	6953	6780	6619	6467	6325	6191	6066	5949	5839
4MW	4000	598460 - (4000 x ΔR)	14094	13510	12977	12488	12038	11622	11238	10882	10551	10243	9955	9687	9437	9202	8983	8777	8584	8403	8233	8074	7925
4MW +2A	6000	755960 - (6000 x ΔR)	17803	17066	16392	15775	15206	14681	14196	13746	13328	12938	12576	12237	11920	11624	11347	11087	10843	10615	10400	10199	10011
4MW + 4A	8000	913460 - (8000 x ΔR)	21512	20622	19808	19061	18374	17740	17153	16610	16104	15634	15196	14786	14404	14046	13711	13397	13102	12826	12567	12324	12096
4MW +6A	10000	1070960 - (10000 x ΔR)	25221	24177	23223	22348	21542	20799	20111	19473	18881	18330	17816	17336	16888	16468	16075	15707	15362	15038	14734	14449	14182
4MW +8A	12000	1228460 - (12000 x ΔR)	28931	27733	26639	25635	24710	23857	23069	22337	21658	21026	20436	19886	19371	18890	18439	18017	17621	17249	16901	16574	16268
4MW +10A	14000	1385960 - (14000 x ΔR)		31289	30054	28921	27879	26916	26026	25201	24435	23721	23056	22435	21855	21312	20804	20327	19880	19461	19068	18699	18354
4MW +12A	16000	1543460 - (16000 x ΔR)				32208	31047	29975	28984	28065	27212	26417	25676	24985	24338	23734	23168	22637	22139	21673	21235	20824	20440
4MW +12A +2AA	18000	1700960 - (18000 x ΔR)							31942	30929	29989	29113	28296	27534	26822	26156	25532	24947	24398	23884	23402	22949	22525
4MW +12A +4AA	20000	1858460 - (20000 x ΔR)										31808	30917	30084	29306	28578	27896	27257	26658	26096	25568	25074	24611
4MW +12A +6AA	22000	2015960 - (22000 x ΔR)													31789	31000	30260	29566	28917	28307	27735	27199	26697
4MW +12A +8AA	24000	2173460 - (24000 x ΔR)																31876	31176	30519	29902	29324	28783

$$T_n = (W \times TF) - M\sin(\theta - 12.5°) \quad \text{in·lb}$$

T_n = instantaneous net required reducer torque at crankshaft at any crank angle θ (usually in 15° increments)

W = instantaneous well load at crank angle θ determined by dynamometer readings — after translating position of rod, POR, to crank angle θ per POR charts (usually in 15° increments)

θ = instantaneous crank angle defining the clockwise angular position of the line between crankshaft and crank pin from its 12 o'clock spatial position

τ = -12.5° which means that the crank weight and its weight complement have a composite center of gravity which trails crank angle θ by 12.5° with crankshaft rotating clockwise

TF = torque factor describing number of in·lb of torque at crankshaft per 1 lb. of well load at any instantaneous crank angle θ at any stroke setting per TF charts (usually in 15° increments)

M = maximum moment of crank weight and its weight complement at crankshaft for any radially adjusted position of the weight complement (occurs at θ = 102.5° crank angle)

ΔR = distance that weight complement is adjusted radially inward from the fully outboard position

M { • obtained directly from above chart for any ΔR or • $M = 1.0243 \times 90°CBE \times 90°TF$ in·lb }

90°CBE = exact counterbalance effect at polished rod at θ=90° crank angle for any weight complement, for any stroke setting and for any ΔR inward adjustment of weight complement

$$90°CBE = 90°CBE_s - \frac{\Delta R}{78.75} \times (90°CBE_s - 90°CBE_{sco}) \quad \text{lbs}$$

$90°CBE_s$ = counterbalance effect off chart for any fully-outboard weight complement and for any stroke, including interpolated values for any stroke in between those listed

$90°CBE_{sco}$ = counterbalance effect off chart for cranks only configuration, including interpolated values for any stroke in between those listed

Note: Exact 90°CBE can *also* be measured in the field by disconnecting the well load and measuring force required at carrier bar for linkage equilibrium at crank angle θ=90°

* *Crank accommodates 4 master weights (4MW) each weighing 1000# and has auxiliary weights available (A) each weighing 1000# and other auxiliary weights (AA) each weighing 1000# — with (AA) auxiliaries only to be used if total required weight complement exceeds 4MW+12A*

Notes:

1. *APS units should only be operated in clockwise direction as defined with polished rod to the right.*
2. *When having to adjust weight complement radially inward, it is necessary to adjust each of the 4 weight sub-complements radially inward the same amount as measured from the outboard end of each crank.*
3. *In certain special cases, the weight sub-complements can be configured to modify the phase angle τ if desired (consult APS).*
4. *Counterbalance effect interpolation can be completely avoided if operation is at any of the exact strokes in the charts, which are listed in 4" increments.*

COUNTERBALANCE DATA

APS MODEL 305-100

COUNTERBALANCE EFFECT AT $\theta = 90°$ CRANK ANGLE

(PHASE ANGLE $\tau = -15.75°$)

WEIGHT COMPLEMENT*	TOTAL WEIGHT ADDED	MAXIMUM MOMENT, M (OCCURS AT $\theta = 105.75°$)	52"	56"	60"	64"	68"	72"	76"	80"	84"	88"	92"	96"	100"
			NOTE: STRUCTURAL UNBALANCE IS ZERO FOR ALL STROKES												
CRANKS ONLY	0	106610	4271	3979	3727	3507	3314	3143	2991	2855	2734	2624	2526	2436	2356
2MW	2000	205610 - (2000 x ΔR)	8237	7674	7188	6764	6391	6062	5769	5508	5273	5062	4871	4699	4543
4MW	4000	304610 - (4000 x ΔR)	12204	11369	10649	10021	9469	8981	8547	8160	7812	7499	7217	6962	6731
4MW + 2A	6000	403610 - (6000 x ΔR)	16170	15065	14110	13278	12547	11900	11325	10812	10351	9937	9563	9225	8919
4MW + 4A	8000	502610 - (8000 x ΔR)	20136	18760	17571	16534	15624	14819	14103	13464	12890	12374	11909	11488	11107
4MW + 6A	10000	601610 - (10000 x ΔR)	24103	22455	21032	19791	18702	17738	16881	16116	15429	14812	14254	13750	13295
4MW + 8A	12000	700610 - (12000 x ΔR)		26150	24493	23048	21779	20657	19659	18768	17968	17249	16600	16013	15483
4MW + 10A	14000	799610 - (14000 x ΔR)				26305	24857	23576	22438	21420	20507	19687	18946	18276	17670
4MW + 12A	16000	898610 - (16000 x ΔR)						26495	25216	24072	23046	22124	21292	20539	19858
4MW + 12A + 2AA	18000	997610 - (18000 x ΔR)								26724	25586	24562	23637	22802	22046
4MW + 12A + 4AA	20000	1096610 - (20000 x ΔR)										26999	25983	25065	24234

$$T_n = (W \times TF) - M\sin(\theta - 15.75°) \text{ in·lb}$$

T_n = instantaneous net required reducer torque at crankshaft at any crank angle θ (usually in 15° increments)
W = instantaneous well load at crank angle θ determined by dynamometer readings — after translating position of rod, POR, to crank angle θ per POR charts (usually in 15° increments)
θ = instantaneous crank angle defining the clockwise angular position of the line between crankshaft and crank pin from its 12 o'clock spatial position
τ = -15.75° which means that the crank weight and its weight complement have a composite center of gravity which trails crank angle θ by 15.75° with crankshaft rotating clockwise
TF = torque factor describing number of in·lb of torque at crankshaft per 1 lb. of well load at any instantaneous crank angle θ at any stroke setting per TF charts (usually in 15° increments)
M = maximum moment of crank weight and its weight complement at crankshaft for any radially adjusted position of the weight complement (occurs at $\theta = 105.75°$ crank angle)
ΔR = distance that weight complement is adjusted radially inward from the fully outboard position

M
- obtained directly from above chart for any ΔR
- or
- $M = 1.0390 \times 90°CBE \times 90°TF$ in·lb

90°CBE = exact counterbalance effect at polished rod at $\theta = 90°$ crank angle for any weight complement, for any stroke setting and for any ΔR inward adjustment of weight complement

$$90°CBE = 90°CBE_s - \frac{\Delta R}{49.5} \times (90°CBE_s - 90°CBE_{sco}) \text{ lbs}$$

$90°CBE_s$ = counterbalance effect off chart for any fully-outboard weight complement and for any stroke, including interpolated values for any stroke in between those listed
$90°CBE_{sco}$ = counterbalance effect off chart for cranks only configuration, including interpolated values for any stroke in between those listed
Note: Exact 90°CBE can *also* be measured in the field by disconnecting the well load and measuring force required at carrier bar for linkage equilibrium at crank angle $\theta = 90°$

* *Crank accommodates 4 master weights (4MW) each weighing 1000# and has auxiliary weights available (A) each weighing 1000# and other auxiliary weights (AA) each weighing 1000# — with (AA) auxiliaries only to be used if total required weight complement exceeds 4MW+12A*

Notes:
1. *APS units should only be operated in clockwise direction as defined with polished rod to the right.*
2. *When having to adjust weight complement radially inward, it is necessary to adjust each of the 4 weight sub-complements radially inward the same amount as measured from the outboard end of each crank.*
3. *In certain special cases, the weight sub-complements can be configured to modify the phase angle τ if desired (consult APS).*
4. *Counterbalance effect interpolation can be completely avoided if operation is at any of the exact strokes in the charts, which are listed in 4" increments.*

TORQUE FACTORS AND POSITION OF ROD DATA

APS MODEL 365-168

CRANK ANGLE θ	88" STROKE TF	88" STROKE POR	92" STROKE TF	92" STROKE POR	96" STROKE TF	96" STROKE POR	100" STROKE TF	100" STROKE POR	104" STROKE TF	104" STROKE POR	108" STROKE TF	108" STROKE POR	112" STROKE TF	112" STROKE POR	116" STROKE TF	116" STROKE POR	120" STROKE TF	120" STROKE POR	124" STROKE TF	124" STROKE POR	
0°	-9.94	.012	-10.42	.012	-10.90	.012	-11.38	.012	-11.86	.012	-12.35	.012	-12.85	.012	-13.34	.012	-13.84	.012	-14.35	.012	
15°	2.47	.001	2.60	.001	2.73	.001	2.85	.001	2.98	.001	3.10	.001	3.21	.001	3.33	.001	3.44	.001	3.54	.001	
30°	14.61	.026	15.33	.026	16.06	.027	16.79	.027	17.52	.027	18.26	.027	18.99	.027	19.72	.027	20.45	.027	21.18	.027	
45°	25.30	.086	26.54	.087	27.78	.087	29.02	.087	30.27	.087	31.52	.088	32.78	.088	34.03	.088	35.29	.088	36.55	.089	
60°	33.61	.175	35.20	.175	36.79	.176	38.39	.176	39.99	.177	41.59	.177	43.18	.177	44.78	.178	46.38	.178	47.97	.179	
75°	39.01	.283	40.77	.284	42.54	.285	44.30	.285	46.05	.286	47.80	.286	49.54	.287	51.27	.287	52.99	.287	54.70	.288	
90°	41.45	.404	43.25	.404	45.02	.405	46.79	.405	48.53	.405	50.27	.406	51.99	.406	53.69	.406	55.37	.406	57.04	.406	128" through 168" stroke data cont'd below
105°	41.26	.527	42.97	.527	44.65	.528	46.32	.528	47.97	.527	49.60	.527	51.21	.527	52.79	.527	54.35	.527	55.89	.526	
120°	38.85	.647	40.43	.647	41.98	.646	43.51	.646	45.02	.645	46.51	.644	47.98	.644	49.42	.643	50.84	.642	52.24	.641	
135°	34.62	.757	36.04	.756	37.45	.755	38.84	.754	40.21	.753	41.56	.751	42.91	.750	44.23	.749	45.53	.747	46.82	.746	
150°	28.80	.851	30.05	.850	31.30	.849	32.54	.848	33.78	.846	35.01	.845	36.24	.843	37.47	.841	38.69	.839	39.90	.837	
165°	21.43	.926	22.48	.925	23.54	.924	24.61	.923	25.69	.921	26.78	.920	27.89	.918	29.01	.917	30.15	.915	31.30	.913	
180°	12.50	.977	13.27	.977	14.06	.976	14.87	.975	15.72	.974	16.60	.973	17.50	.972	18.45	.971	19.43	.969	20.44	.968	
195°	2.11	.999	2.46	.999	2.84	.999	3.25	.999	3.71	.999	4.20	.998	4.74	.998	5.32	.998	5.96	.997	6.64	.997	
210°	-9.33	.989	-9.54	.989	-9.72	.990	-9.88	.990	-10.01	.991	-10.11	.992	-10.17	.992	-10.20	.993	-10.19	.993	-10.14	.994	
225°	-20.86	.944	-21.71	.945	-22.55	.946	-23.39	.947	-24.22	.948	-25.04	.949	-25.86	.950	-26.67	.951	-27.48	.952	-28.29	.953	
240°	-31.21	.866	-32.65	.867	-34.10	.868	-35.56	.869	-37.03	.870	-38.52	.871	-40.03	.872	-41.56	.874	-43.11	.875	-44.70	.876	
255°	-39.19	.760	-41.06	.761	-42.94	.762	-44.83	.763	-46.74	.764	-48.68	.765	-50.64	.766	-52.61	.766	-54.62	.767	-56.66	.768	
270°	-44.07	.636	-46.16	.636	-48.25	.637	-50.36	.638	-52.47	.638	-54.60	.639	-56.74	.639	-58.89	.640	-61.06	.640	-63.24	.640	
285°	-45.59	.502	-47.72	.502	-49.85	.503	-51.98	.503	-54.11	.503	-56.24	.504	-58.37	.504	-60.50	.504	-62.63	.504	-64.76	.504	
300°	-43.83	.368	-45.85	.368	-47.87	.368	-49.89	.369	-51.90	.369	-53.91	.369	-55.91	.370	-57.90	.370	-59.88	.370	-61.85	.370	
315°	-39.01	.244	-40.81	.244	-42.61	.244	-44.40	.245	-46.18	.245	-47.96	.245	-49.73	.245	-51.49	.246	-53.25	.246	-54.99	.246	
330°	-31.44	.138	-32.90	.139	-34.36	.139	-35.82	.139	-37.28	.139	-38.74	.139	-40.19	.140	-41.63	.140	-43.07	.140	-44.50	.140	
345°	-21.54	.059	-22.56	.059	-23.58	.059	-24.60	.059	-25.62	.060	-26.65	.060	-27.67	.060	-28.70	.060	-29.72	.060	-30.74	.060	

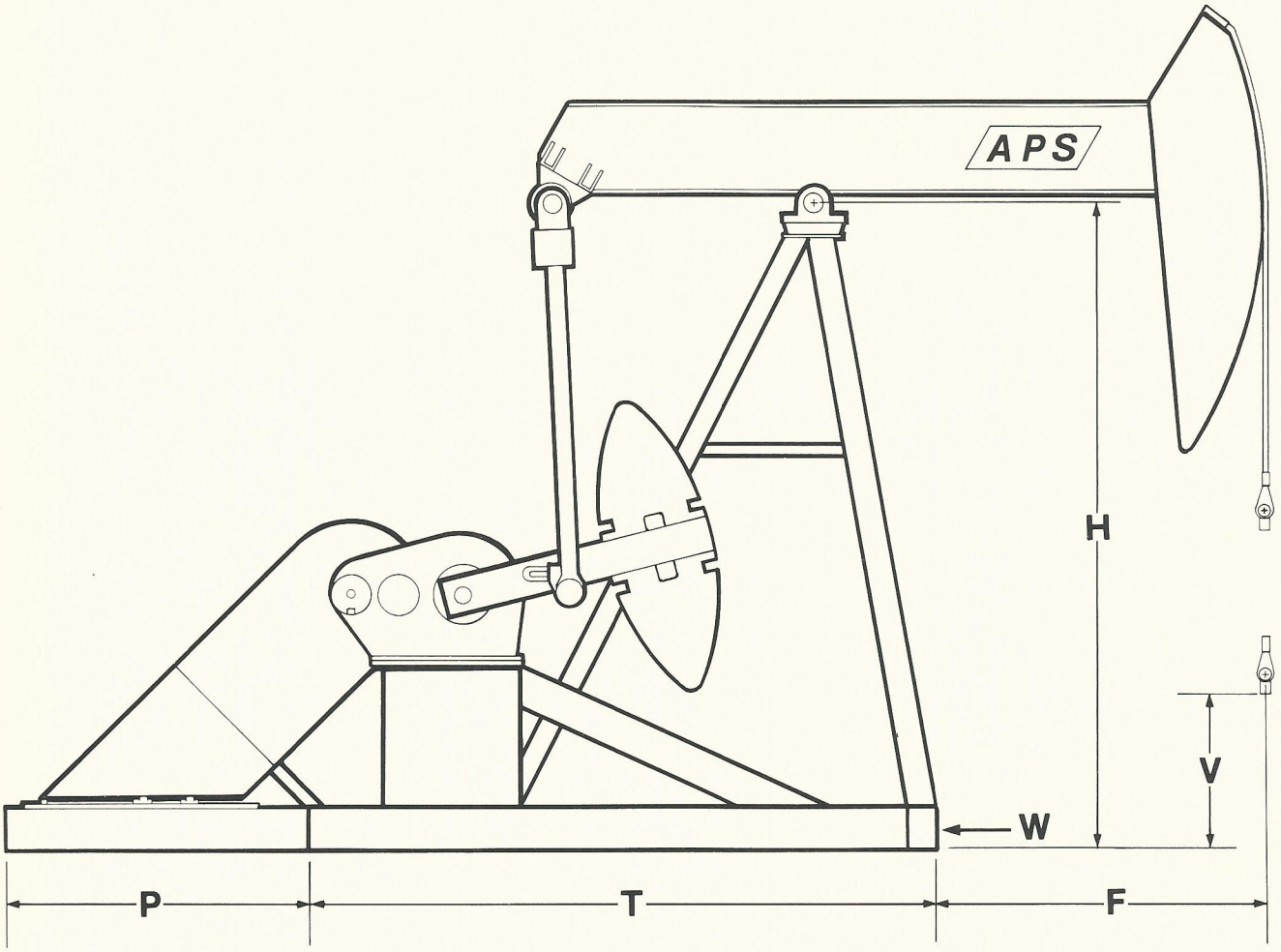
CRANK ANGLE θ	128" STROKE TF	128" STROKE POR	132" STROKE TF	132" STROKE POR	136" STROKE TF	136" STROKE POR	140" STROKE TF	140" STROKE POR	144" STROKE TF	144" STROKE POR	148" STROKE TF	148" STROKE POR	152" STROKE TF	152" STROKE POR	156" STROKE TF	156" STROKE POR	160" STROKE TF	160" STROKE POR	164" STROKE TF	164" STROKE POR	168" STROKE TF	168" STROKE POR
0°	-14.85	.012	-15.36	.012	-15.87	.012	-16.37	.012	-16.89	.013	-17.40	.013	-17.90	.013	-18.41	.013	-18.92	.013	-19.42	.013	-19.91	.013
15°	3.64	.001	3.74	.001	3.83	.001	3.92	.001	4.01	.001	4.08	.001	4.16	.001	4.23	.001	4.29	.001	4.35	.001	4.40	.001
30°	21.91	.027	22.63	.027	23.35	.027	24.06	.027	24.77	.027	25.47	.027	26.16	.027	26.84	.027	27.52	.027	28.18	.027	28.82	.027
45°	37.80	.089	39.05	.089	40.30	.089	41.54	.089	42.77	.089	44.00	.089	45.21	.089	46.41	.089	47.60	.089	48.77	.089	49.92	.089
60°	49.55	.179	51.13	.179	52.71	.179	54.27	.179	55.82	.180	57.36	.180	58.88	.180	60.39	.180	61.87	.179	63.33	.179	64.77	.179
75°	56.40	.288	58.09	.288	59.76	.288	61.41	.288	63.05	.288	64.66	.288	66.25	.288	67.82	.288	69.36	.288	70.87	.287	72.35	.287
90°	58.69	.406	60.31	.406	61.91	.406	63.49	.406	65.04	.406	66.57	.405	68.06	.405	69.53	.404	70.96	.403	72.36	.402	73.72	.401
105°	57.40	.526	58.89	.525	60.34	.524	61.77	.524	63.18	.523	64.55	.522	65.89	.520	67.20	.519	68.47	.518	69.71	.516	70.91	.514
120°	53.61	.640	54.96	.638	56.28	.637	57.58	.635	58.84	.634	60.08	.632	61.29	.630	62.46	.628	63.61	.626	64.72	.624	65.80	.621
135°	48.09	.744	49.34	.742	50.57	.740	51.78	.738	52.96	.736	54.13	.733	55.27	.731	56.39	.728	57.48	.725	58.55	.722	59.59	.719
150°	41.11	.835	42.31	.833	43.50	.831	44.69	.828	45.87	.826	47.04	.823	48.20	.820	49.34	.817	50.47	.814	51.59	.810	52.68	.806
165°	32.46	.911	33.64	.909	34.83	.906	36.03	.904	37.25	.902	38.47	.899	39.71	.896	40.96	.893	42.22	.890	43.48	.886	44.75	.883
180°	21.49	.966	22.59	.965	23.72	.963	24.90	.962	26.12	.960	27.40	.958	28.71	.955	30.07	.953	31.49	.950	32.94	.948	34.45	.945
195°	7.38	.997	8.18	.996	9.05	.995	9.99	.995	11.00	.994	12.10	.993	13.28	.992	14.55	.991	15.92	.990	17.41	.989	19.00	.987
210°	-10.04	.994	-9.90	.995	-9.70	.995	-9.44	.996	-9.11	.997	-8.72	.997	-8.24	.998	-7.68	.998	-7.02	.998	-6.23	.999	-5.33	.999
225°	-29.09	.954	-29.89	.956	-30.69	.957	-31.49	.958	-32.29	.959	-33.10	.960	-33.91	.961	-34.73	.963	-35.57	.964	-36.42	.965	-37.29	.966
240°	-46.31	.877	-47.95	.878	-49.64	.879	-51.37	.880	-53.15	.881	-54.99	.881	-56.90	.882	-58.88	.883	-60.95	.884	-63.11	.885	-65.39	.885
255°	-58.72	.768	-60.82	.769	-62.96	.769	-65.13	.770	-67.35	.770	-69.61	.770	-71.92	.770	-74.28	.770	-76.69	.770	-79.16	.770	-81.69	.769
270°	-65.43	.640	-67.63	.640	-69.85	.640	-72.08	.640	-74.32	.640	-76.58	.640	-78.84	.639	-81.11	.639	-83.39	.638	-85.67	.637	-87.95	.636
285°	-66.89	.504	-69.01	.504	-71.12	.504	-73.22	.504	-75.32	.503	-77.40	.503	-79.47	.502	-81.52	.501	-83.55	.501	-85.56	.499	-87.55	.498
300°	-63.81	.370	-65.76	.370	-67.69	.370	-69.60	.369	-71.49	.369	-73.36	.369	-75.21	.368	-77.03	.368	-78.82	.367	-80.59	.366	-82.31	.365
315°	-56.71	.246	-58.43	.246	-60.12	.246	-61.80	.246	-63.46	.246	-65.10	.246	-66.71	.245	-68.30	.245	-69.86	.245	-71.39	.244	-72.88	.244
330°	-45.92	.140	-47.34	.140	-48.74	.141	-50.12	.141	-51.50	.141	-52.85	.141	-54.19	.141	-55.51	.141	-56.81	.141	-58.08	.141	-59.32	.140
345°	-31.76	.060	-32.78	.061	-33.79	.061	-34.80	.061	-35.80	.061	-36.79	.061	-37.77	.061	-38.74	.061	-39.70	.061	-40.64	.061	-41.56	.061

APS MODEL 305-100

CRANK ANGLE θ	52" STROKE TF	52" STROKE POR	56" STROKE TF	56" STROKE POR	60" STROKE TF	60" STROKE POR	64" STROKE TF	64" STROKE POR	68" STROKE TF	68" STROKE POR	72" STROKE TF	72" STROKE POR	76" STROKE TF	76" STROKE POR	80" STROKE TF	80" STROKE POR	84" STROKE TF	84" STROKE POR	88" STROKE TF	88" STROKE POR	92" STROKE TF	92" STROKE POR	96" STROKE TF	96" STROKE POR	100" STROKE TF	100" STROKE POR
0°	-7.45	.020	-8.02	.020	-8.59	.020	-9.16	.020	-9.74	.020	-10.31	.019	-10.89	.019	-11.46	.019	-12.04	.019	-12.61	.019	-13.17	.019	-13.73	.019	-14.29	.019
15°	-.33	.000	-.33	.000	-.33	.000	-.33	.000	-.33	.000	-.33	.000	-.34	.000	-.34	.000	-.35	.000	-.37	.000	-.39	.000	-.41	.000	-.44	.000
30°	6.71	.016	7.29	.016	7.86	.017	8.44	.017	9.02	.017	9.60	.017	10.17	.017	10.75	.017	11.32	.017	11.88	.017	12.44	.017	12.98	.017	13.52	.017
45°	13.09	.066	14.17	.067	15.25	.067	16.33	.068	17.42	.068	18.51	.069	19.59	.069	20.68	.069	21.75	.069	22.82	.069	23.88	.069	24.93	.069	25.96	.069
60°	18.29	.146	19.74	.147	21.20	.148	22.65	.148	24.11	.149	25.56	.149	27.01	.150	28.45	.150	29.88	.150	31.30	.151	32.70	.151	34.08	.151	35.43	.151
75°	21.97	.248	23.65	.249	25.32	.250	26.99	.250	28.64	.251	30.29	.252	31.92	.252	33.53	.252	35.12	.253	36.69	.253	38.24	.252	39.75	.252	41.23	.252
90°	24.02	.365	25.79	.365	27.53	.366	29.26	.366	30.96	.366	32.64	.367	34.30	.367	35.93	.367	37.53	.366	39.09	.366	40.62	.365	42.11	.364	43.55	.363
105°	24.52	.487	26.26	.487	27.97	.487	29.65	.487	31.30	.487	32.92	.486	34.51	.486	36.06	.485	37.57	.484	39.04	.483	40.47	.481	41.85	.479	43.18	.477
120°	23.64	.609	25.28	.608	26.90	.608	28.48	.607	30.03	.605	31.54	.604	33.02	.603	34.46	.601	35.86	.599	37.22	.596	38.54	.594	39.81	.591	41.03	.588
135°	21.56	.723	23.07	.722	24.55	.720	26.01	.718	27.45	.716	28.85	.714	30.23	.712	31.58	.709	32.89	.706	34.17	.703	35.41	.699	36.62	.696	37.78	.691
150°	18.40	.824	19.75	.822	21.09	.820	22.42	.818	23.74	.815	25.05	.813	26.34	.810	27.62	.806	28.89	.803	30.13	.799	31.36	.795	32.57	.790	33.75	.785
165°	14.23	.907	15.37	.905	16.53	.903	17.71	.900	18.89	.898	20.09	.895	21.30	.892	22.53	.889	23.77	.885	25.02	.881	26.28	.877	27.55	.872	28.83	.867
180°	9.06	.966	9.93	.965	10.83	.963	11.77	.961	12.75	.959	13.78	.957	14.85	.955	15.97	.952	17.14	.949	18.37	.946	19.65	.943	20.99	.939	22.39	.935
195°	2.97	.997	3.43	.996	3.95	.996	4.51	.995	5.14	.994	5.84	.993	6.60	.992	7.45	.991	8.39	.990	9.42	.988	10.55	.986	11.81	.984	13.19	.982
210°	-3.80	.995	-3.88	.995	-3.92	.996	-3.90	.996	-3.83	.997	-3.70	.997	-3.51	.998	-3.24	.998	-2.89	.999	-2.44	.999	-1.87	1.000	-1.18	1.000	-.34	1.000
225°	-10.75	.958	-11.47	.959	-12.16	.961	-12.83	.962	-13.49	.964	-14.12	.965	-14.74	.967	-15.33	.968	-15.90	.970	-16.44	.971	-16.96	.973	-17.45	.975	-17.92	.977
240°	-17.17	.887	-18.49	.889	-19.83	.891	-21.17	.892	-22.54	.894	-23.93	.896	-25.35	.897	-26.80	.899	-28.30	.900	-29.86	.902	-31.48	.904	-33.18	.905	-34.99	.907
255°	-22.31	.787	-24.11	.789	-25.94	.790	-27.79	.791	-29.67	.793	-31.59	.794	-33.56	.795	-35.57	.796	-37.64	.797	-39.78	.797	-41.99	.798	-44.28	.798	-46.66	.798
270°	-25.68	.666	-27.76	.667	-29.85	.667	-31.97	.668	-34.11	.669	-36.28	.669	-38.47	.670	-40.69	.670	-42.94	.670	-45.23	.670	-47.54	.669	-49.88	.669	-52.25	.668
285°	-27.04	.532	-29.19	.533	-31.36	.533	-33.53	.533	-35.71	.534	-37.90	.534	-40.09	.534	-42.28	.533	-44.47	.533	-46.66	.532	-48.84	.531	-51.01	.530	-53.17	.529
300°	-26.38	.397	-28.46	.397	-30.53	.397	-32.60	.397	-34.66	.397	-36.72	.397	-38.77	.397	-40.80	.397	-42.81	.396	-44.81	.395	-46.77	.395	-48.71	.394	-50.61	.392
315°	-23.85	.270	-25.71	.270	-27.56	.270	-29.40	.270	-31.24	.270	-33.06	.270	-34.87	.269	-36.66	.269	-38.43	.269	-40.17	.268	-41.88	.268	-43.56	.267	-45.20	.266
330°	-19.64	.159	-21.17	.159	-22.69	.159	-24.21	.159	-25.72	.159	-27.21	.159	-28.70	.159	-30.18	.159	-31.63	.159	-33.06	.159	-34.47	.159	-35.85	.158	-37.20	.158
345°	-14.05	.074	-15.14	.074	-16.23	.074	-17.32	.074	-18.40	.074	-19.49	.074	-20.56	.074	-21.63	.074	-22.69	.074	-23.74	.074	-24.78	.074	-25.79	.074	-26.79	.074

TF = torque factor describing number of in·lb of torque at crankshaft per 1 lb. of well load at instantaneous crank angle θ at any stroke setting, including interpolated values for strokes in between those listed.

UNIT DIMENSIONS



	F	H	P	T	V	W
APS MODEL 365-168	133.56"	260.12"	122.00"	251.87"	63.12"	81.50"
APS MODEL 305-100	92.25"	201.83"	122.00"	206.75"	63.12"	65.50"

WARRANTY

In accordance with the standard APS warranty, APS warrants its pumping units against defective material and workmanship for a period of eighteen (18) months after installation or twenty-four (24) months after shipment from factory — whichever occurs first.

Advanced Pumping Systems, Inc. manufactures the new ADVANCED universal pumping unit, related systems and state-of-the-art oil well simulation and analysis equipment.

APS was formed by a group of oil production systems specialists and aerospace design engineers who combined oil industry production expertise with advanced technological engineering to achieve a major breakthrough in pumping technology.

Patents are pending on many design features.

APS equipment surpasses the present competition due to its superior performance, cost effectiveness, operational simplicity and complete versatility.

For more information, contact the Sales Department.

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