

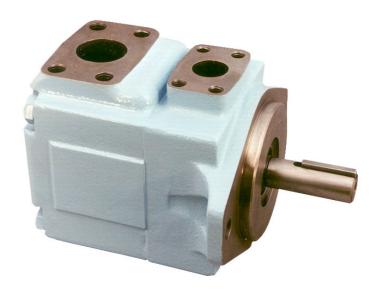
# Vane pumps single, double & triple T6 mobile application



Publ. 1 - AM0701 - A 11 / 98 / 2000 / FB Replaces : 1 - AM 075 - A



#### **FEATURES - T6 SERIES MOBILE APPLICATION**



**GREATER FLOW** 

Greater flow for the envelope size is achieved by increased displacement cam rings: at high permissible speeds with atmospheric inlet

C  $\rightarrow$  3 to 31 GPM, .66 to 6.10 in<sup>3</sup>/rev. D  $\rightarrow$  14 to 50 GPM, 2.90 to 9.64 in<sup>3</sup>/rev. E  $\rightarrow$  42 to 72 GPM, 8.07 to 13.86 in<sup>3</sup>/rev.

**HIGHER PRESSURE** 

Pressure ratings to 4000 PSI reduce size and cost of actuators, valves and lines, give extended life at reduced pressures.

extended fire at reduced pressures

**BETTER EFFICIENCY** 

Better efficiency under load increases productivity, reduces heating and operating

**MOUNTING FLEXIBILITY** 

Up to 32 positions for double pumps and up to 128 for triple pumps: this reduces mounting costs and improves performance.

**LOWER NOISE LEVELS** 

Increase operator safety and acceptance.

**COMPLETE CONFORMITY** 

To SAE - J744c 2-bolt standards and to ISO 3019-1 (T6EDCS SAE E, T6EDCM ISO 3019/2) in the various keyed and splined shaft options offered.

**CARTRIDGE DESIGN** 

Provides for drop-in assemblies. This allows easy conversion or renewal of serviceable elements in minutes at minimum expense and risk of contamination. The "C" & "D" cartridge pumps are birotational and indicated by "B" description in cartridge model number. Pump rotation is easy to change by changing position of cam ring on port plate dowel pin hole.

WIDER RANGE OF ACCEPTABLE VISCOSITIES

Viscosities from 9240 to 60 SUS permit colder starts and hotter running. The balanced design compensates for wear and temperature changes. At high viscosity or cold temperature, the rotor to side plates gap is well lubricated and improves mechanical efficiency.

**FIRE RESISTANT FLUIDS** 

Including phosphate esters, chlorinated hydrocarbons, water glycols and invert emulsions may be pumped at higher pressures and with longer service life by these pumps.

# GENERAL APPLICATIONS INSTRUCTIONS

- 1. Check speed range, pressure, temperature, fluid quality, viscosity and pump rotation.
- 2. Check inlet conditions of the pump, if it can accept application requirement.
- 3. Type of shaft: if it would support operating torque.
- 4. Coupling must be chosen to minimize pump shaft load (weight, misalignment).
- 5. Filtration: must be adequate for lowest contamination level.
- 6. Environment of pump: to avoid noise reflection, pollution and shocks.

#### MINIMUM & MAXIMUM SPEED, PRESSURE RATINGS - T6 SERIES MOBILE APPLICATION

		Theoretical		Maximu	m Speed			Maximum	Pressure		
		Displacement	Minimum	HF-0,HF-1	HF-3, HF-4	HF-0,		HF-1, HF		H	F-3
Size	Series	Vi	Speed	HF-2	HF-5	Int.	Cont.	Int.	Cont.	Int.	Cont.
		in <sup>3</sup> /rev	RPM	RPM	RPM	PSI	PSI	PSI	PSI	PSI	PSI
	B03	.66									
	B05	1.05									
	B06	1.30									
	B08	1.61									
	B10	2.08									
CM	B12	2.26	400	2800	1800	4000	3500	3000	2500	2500	2000
CP	B14	2.81									
	B17	3.56									
	B20	3.89									
	B22	4.29									
	B25	4.84									
	B28	5.42		2500		3000	2300		2300		
	B31	6.10									
	B14	2.90									
	B17	3.55									
	B20	4.03									
	B24	4.85									
DM	B28	5.47	400	2500	1800	3500	3000	3000	2500	2500	2000
DP	B31	6.00									
	B35	6.77									
	B38	7.34									
	B42	8.30									
	B45	8.89		2200							
	B50	9.64				3000	2300		2300		
	042	8.07									
	045	8.69									
EM.	050	9.67	400	2200	1000	2500	2000	2000	2500	2500	2000
EM EP	052	10.06		2200	1800	3500	3000	3000	2500	2500	2000
EI	062	12.00									
	066	13.02					]				
	072	13.86									

HF-0, HF2 = Antiwear Petroleum Base

HF-1 = Non Antiwear Petroleum Base

HF-5 = Synthetic Fluids

HF-3 = Water in oil Emulsions

HF-4 = Water Glycols

For further information or if the performance characteristics outlined above do not meet your own particular requirements, please consult your local DENISON Hydraulics office.

## **PRIMING AT STARTING**

At first, start operation of the pump shaft at the lowest speed and at the lowest pressure to obtain priming. When a pressure relief valve is used at the outlet, it should be backed off to minimize return pressure.

When possible, an air bleed off should be provided in the circuit to facilitate purging of system air.

Never operate pump shaft at top speed and pressure without checking for completion of pump priming, and the fluid has no aeration disaerated.

### MINIMUM ALLOWABLE INLET PRESSURE (PSI ABSOLUTE) - T6 SERIES MOBILE APPLICATION

Cart	ridge				Speed	RPM				
Size	Series	1200	1500	1800	2100	2200	2300	2500	2800	Series
	B03									B03
ı	B05								14.5	B05
	B06					11.6	11.6	13.0		B06
	B08				11.6	11.0				B08
	B10				11.0					B10
CM	B12	11.6	11.6	11.6			12.3	13.3		B12
CP	B14									B14
	B17					12.3		13.7	14.9	B17
	B20						13.0			B20
	B22				12.3	13.0		14.2	15.2	B22
	B25				13.0	13.7	13.7	15.2		B25
	B28					14.5	14.5	15.7		B28
	B31				12.3	13.0	14.5	16.1		B31
	B14									B14
	B17				11.6	12.8	13.7	14.5		B17
	B20			11.6						B20
	B24	11.6	11.6		11.9			15.9		B25
DM	B28				11.0	12.3	13.3	14.5	17.1	
DP	B31				13.0	13.7		17.8		B31
	B35				13.3	14.2	14.8	18.7		B35
	B38				13.7	14.5	15.2			B38
	B42					14.8	15.7			B42
	B45			12.3	14.2	115.2				B45
	B50				14.8	15.8				B50
	042				12.8					042
	045									045
EM	050	11.6	11.6	11.6	13.0	14.5				050
EP	052									052
	062			12.3	13.7					062
	066	12.3	12.3	13.7	14.5	15.8				066
	072			12.3		15.2				072

Inlet pressure is measured at inlet flange with petroleum base fluids at viscosity between 60 and 300 SUS. The difference between inlet pressure at the pump flange and atmospheric pressure must not exceed 2.9 PSI to prevent aeration.

Multiply absolute pressure by 1,25 for HF-3, HF-4 fluids. by 1,35 for HF-5 fluid.

by 1,10 for ester or rapeseed base.

Use highest cartridge absolute pressure for double & triple pump.

#### **GENERAL CHARACTERISTICS**

	Mounting standard	Weight without connector and	Moment of inertia Lb.in <sup>2</sup>	J518c -		SAE 4 bolts SO/DIS 6162-1 - <sup>4)</sup> ISO/DIS 6162-2			
		bracket - Lbs		Suction		Pressure			
T6CM	SAE J744c ISO/3019-1 SAE B	34.0	2.6	1"1/2		1"			
T6CP		39.7	2.7	2" <sup>4)</sup>		1"1/4 <sup>4)</sup>			
T6D*	SAE J744c	53.0	7.9	2"		1"1/4			
T6E*	ISO/3019-1 SAE C	95.0	16.6	3"		1"1/2			
T6CC*	SAE J744c	57.3	5.1	2"1/2 or	P1		22		
	ISO/3019-1 SAE B			3"	1"	1" o	r 3/4"		
T6DC*		80.7	10.4	3"	1"1/4		1"		
T6EC*	SAE J744c	121.0	25.0	3"1/2	1"1/2		1"		
T6ED*	ISO/3019-1 SAE C	145.5	25.0	4"	1"1/2	1'	1/4		
T6DCC*		134.5	12.7	4"	P1	P2	Р3		
				·	1"1/4	1"	1" or 3/4"		
T6EDC*	SAE "E" (T6EDCS) ISO/3019-2 (T6EDCM)	220.4	27.4	4"	1"1/2	1"1/4	1" or 3/4"		

#### **PUMP SELECTION - T6 SERIES MOBILE APPLICATION**

#### **CALCULATION**

#### **ROUTINE AND EXAMPLE**

Routine: Example:

1. First calculation 
$$Vi = \frac{231 Q}{n}$$
  $Vi = \frac{231 x 15.8}{1500} = 2.43 \text{ in}^3/\text{rev}.$ 

2. Choice Vi of pump immediately 
$$T6CM B14 Vi = 2.81 in^3/rev.$$
 greater (see tabulation)

3. Theoretical flow of this pump 
$$q_{Vi} = \frac{Vp \times n}{231} = 18.2 \text{ GPM}$$

4. Find 
$$qv_s$$
 leakage function of T6CM (page 10) :  $qv_s = 1.3$  GPM at pressure  $qv_s = f(p)$  on curve at 60 or 2200 PSI, 115 SUS

5. Available flow 
$$q_{Ve} = q_{Vi} - q_{Vs}$$
  $q_{Ve} = 18.2 - 1.3 = 16.9 \text{ GPM}$ 

6. Theoretical input power
$$Pi = \frac{qvi \times p}{1714} = 23.4 \text{ HP}$$

8. Calculation of necessary input 
$$P = 23.4 + 2.1 = 25.5 \text{ HP}$$
  
power  $P = Pi + Ps$ 

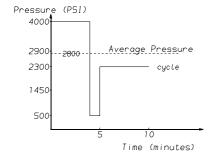
9. Results 
$$Vi = 2.81 \text{ in}^3/\text{rev}$$

$$q_{Ve} = 16.96 \text{ GPM} \qquad T6\text{CM B}14$$

$$P = 25,50 \text{ HP}$$

These calculation steps must be followed for each application.

# INTERMITTENT PRESSURE RATING



T6 units may be operated intermittently at pressures higher than the recommended continuous rating when the time weighted average of pressure is less than or equal to the continuous duty pressure rating.

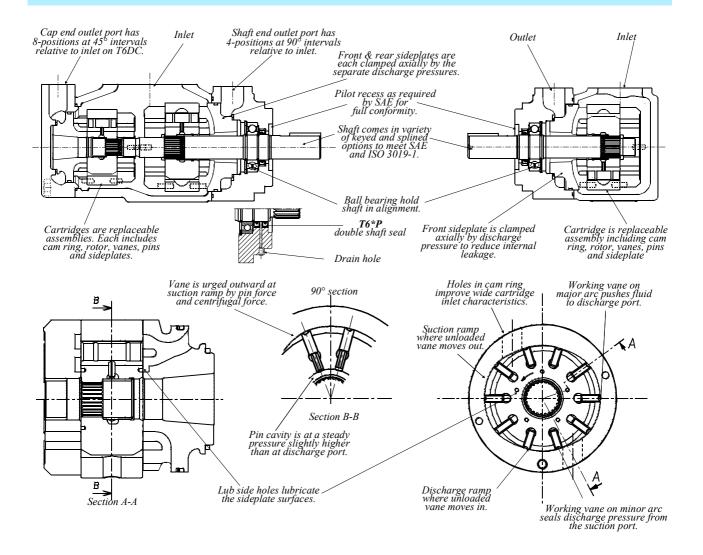
This intermittent pressure rating calculation is only valid if other parameters; speed, fluid, viscosity and contamination level are respected.

For total cycle time higher than 15 minutes, please consult your DENISON Hydraulics representative.

$$\frac{(4 \times 4000) + (1 \times 500) + (5 \times 2300)}{10} = 2800 \text{ PSI}$$

 $2800\ PSI$  is lower than  $3500\ PSI$  allowed as continuous pressure for T6CM - B14 with HF-0 fluid.

#### **DESCRIPTION - T6 SERIES MOBILE APPLICATION**



#### **APPLICATION ADVANTAGES**

- The high pressure capability to 4000 PSI, in the small envelope, reduces installation costs and provides extended life at reduced pressure.
- The high volumetric efficiency, typically 94%, reduces heat generation, and allows speeds down to 400 RPM at full pressure.
- The high mechanical efficiency, typically 94%, reduces energy consumption.
- The wide speed range from 400 RPM to 2800 RPM, combined with large size cartridge displacements, will optimize operation for the lowest noise level in the smallest envelope.
- The low speed 400 RPM, low pressure, high viscosity 9240 SUS allow application in cold environments with minimum energy consumption and without seizure risk.
- The low ripple pressure ± 29 PSI reduces piping noise and increases life time of other components in the circuit.
- The high resistance to particle contamination because of the double lip vane increases pump life.
- The large variety of options (cam displacement, shaft, porting) allows customized installation.
- The shaft option T (SAE J718c), allows direct drive (at 540 or 1000 RPM) on tractors.
- The double shaft seal (T6\*P version) and drain hole allow direct mounting onto gear boxes.

#### SHAFTS AND HYDRAULIC FLUIDS - T6 SERIES MOBILE APPLICATION

#### **RECOMMENDED FLUIDS**

Petroleum based antiwear R & O fluids.

These fluids are the recommended fluids for T6 series pumps. Maximum catalog ratings and performance data are based on operation with these fluids. These fluids are covered by DENISON Hydraulics HF-0 and HF-2 specification.

# ACCEPTABLE ALTERNATE FLUIDS

The use of fluids other than petroleum based antiwear R & O fluids, requires that the maximum ratings of the pumps will be reduced. In some cases the minimum replenishment pressures must be increased. Consult specific sections for more details.

VISCOSITY	Max (cold start, low speed & pressure)	9240 (SUS)
	Max (full speed & pressure)	500 (SUS)
	Optimum (max. life)	140 (SUS)
	Min (full speed & pressure for HF-1, HF-3, HF-4 & HF-5 fluids)	90 (SUS)
	Min (full speed & pressure for HF-0 & HF-2 fluids)	60 (SUS)

#### **VISCOSITY INDEX**

90° min. higher values extend range of operating temperatures.

Maximum fluid temperature ( $\theta$ ) <sup>*</sup> F	
HF-0, HF-1, HF-2	+ 212
HF-3, HF-4	+ 122
HF-5	+ 158
Biodegradable fluids (esters & rapeseed base)	+ 149

Minimum fluid temperature (θ) °F	
HF-0, HF-1, HF-2, HF-5	- 0.4
HF-3, HF-4	+ 50
Biodegradable fluids (esters & rapeseed base)	- 4.4

#### **FLUID CLEANLINESS**

The fluid must be cleaned before and during operation to maintain contamination level of NAS 1638 class 8 (or ISO 18/14) or better. Filters with 25 micron (or better  $\text{B10} \leq 100$ ) nominal ratings may be adequate but do not guarantee the required cleanliness levels. Suction strainers must be of adequate size to provide minimum inlet pressure specified. 100 mesh (149 micron) is the finest mesh recommended. Use oversize strainers or omit them altogether on applications which require cold starts or use fire resistant fluids.

# OPERATING TEMPERATURES AND VISCOSITIES

Operating temperatures are a function of fluid viscosities, fluid type, and the pump. Fluid viscosity should be selected to provide optimum viscosity at normal operating temperatures. For cold starts the pumps should be operated at low speed and pressure until fluid warms up to an acceptable viscosity for full power operation.

# WATER CONTAMINATION IN THE FLUID

Maximum acceptable content of water.

- 0,10 % for mineral base fluids.
- 0,05 % for synthetic fluids, crankcase oils, biodegradable fluids. If amount of water is higher, then it should be drained off the circuit.

#### **COUPLINGS AND FEMALE SPLINES**

- $\bullet$  The mating female spline should be free to float and find its own center. If both members are rigidly supported, they must be aligned within .006 TIR or less to reduce fretting. The angular alignment of two spline axes must be less than  $\pm$  .002" per 1" radius.
- The coupling spline must be lubricated with a lithium molydisulfide grease or a similar lubricant.
- The coupling must be hardened to a hardness between 27 and 45 R.C.
- The female spline must be made to conform to the Class 1 fit as described in SAE-J498b (1971). This is described as a Flat Root Side Fit.

#### **KEYED SHAFTS**

DENISON Hydraulics supplies the T6 series keyed shaft pumps with high strength heat-treated keys. Therefore, when installing or replacing these pumps, the heat-treated keys must be used in order to insure maximum life in the application. If the key is replaced it must be a heat-treated key between 27 and 34 R.C. hardness. The corners of the keys must be chamfered from .030" to .040 at 45° to clear radii in the key way.

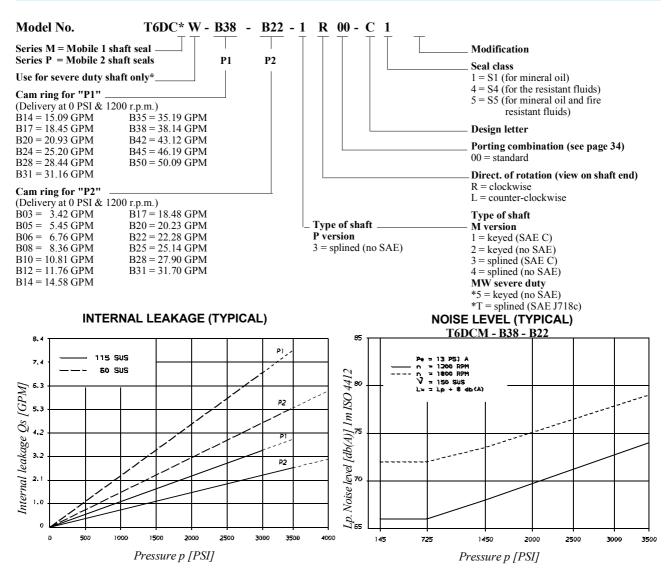
NOTE

Alignment of keyed shafts must be within tolerances given for splined shafts.

**SHAFT LOADS** 

These products are designed primarily for coaxial drives which do not impose axial or side loading on the shaft. Consult specific sections for more details.

#### **ORDERING CODE - T6DC\* SERIES MOBILE APPLICATION**



Do not operate the pump more than 5 seconds at any speed or viscosity if internal leakage is more than 50% of theoretical flow. Total leakage is the sum of each section loss at its operating conditions.

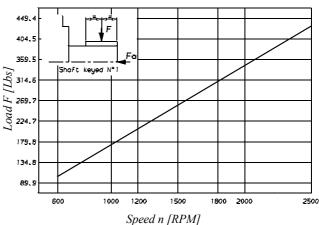
Double pump noise level is given with each section discharging at the pressure noted on the curve.

#### POWER LOSS HYDROMECHANICAL (TYPICAL)

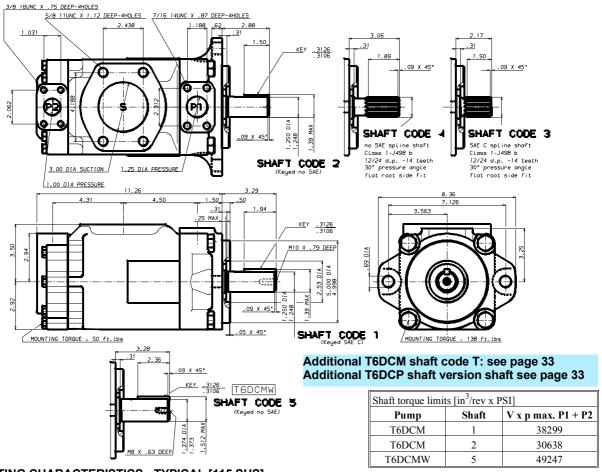
#### 8.0 2400 1800 I115 SUSI 1200 6.7 5.4 4.0 2.7 Power loss Ps [HP] 1.3 1500 2000 2500 3000 3500 5.7 n = 2400 n = 1800 n = 1200 ະາາຮ ຮ**ນ**ຮນ 5.4 4.0 2.7 1.3 0 500 1000 1500 2000 2500 3000 3500 4000 Pressure p [PSI]

Total hydrodynamic power loss is the sum of each section at its operating conditions.

#### PERMISSIBLE RADIAL LOAD



Maximum permissible axial load Fa = 270 Lbs



#### **OPERATING CHARACTERISTICS - TYPICAL [115 SUS]**

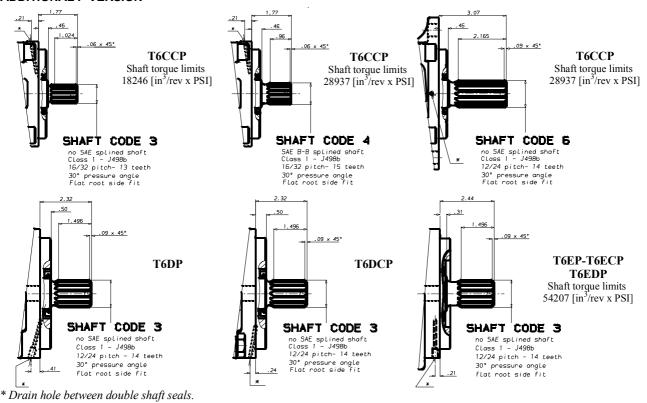
Pressure	Series	Volumetric	Flow Q [	GPM] & n = 1	800 RPM	Input power P [HP] & n = 1800 RPM			
port		Displacement Vp	p = 0 PSI	p = 2000 PSI	p = 3500 PSI	p = 100 PSI	p = 2000 PSI	p = 3500 PSI	
	B14	2.90 in <sup>3</sup> /rev	22.64	20.46	18.82	4.02	29.31	49.34	
	B17	3.55 in <sup>3</sup> /rev	27.68	25.50	23.86	4.31	35.20	59.64	
	B20	4.00 in <sup>3</sup> /rev	31.39	29.21	27.57	4.53	39.52	67.21	
	B24	4.80 in <sup>3</sup> /rev	37.82	35.63	33.99	4.91	47.02	80.32	
P1	B28	5.50 in <sup>3</sup> /rev	42.66	40.48	38.84	5.19	52.68	90.23	
	B31	6.00 in <sup>3</sup> /rev	46.75	44.57	42.93	5.43	57.45	98.58	
	B35	6.80 in <sup>3</sup> /rev	52.79	50.61	48.97	5.78	64.50	110.91	
	B38	7.30 in <sup>3</sup> /rev	57.21	55.03	53.39	6.04	69.66	119.94	
	B42 <sup>2)</sup>	8.30 in <sup>3</sup> /rev	64.68	62.50	60.86	6.47	78.37	135.19	
	B45 <sup>2)</sup>	8.90 in <sup>3</sup> /rev	69.29	67.11	65.47	6.74	83.75	144.61	
	B50 <sup>2)</sup>	9.64 in <sup>3</sup> /rev	75.14	72.96	71.78 <sup>1)</sup>	7.08	90.58	134.54 <sup>1)</sup>	
	B03	.66 in <sup>3</sup> /rev	5.14	3.61	-	2.11	8.45	-	
	B05	1.05 in <sup>3</sup> /rev	8.18	6.65	5.56	2.29	12.00	19.59	
	B06	1.30 in <sup>3</sup> /rev	10.13	8.60	7.51	2.40	14.28	23.57	
	B08	1.61 in <sup>3</sup> /rev	12.55	11.02	9.93	2.54	17.11	28.53	
	B10	2.08 in <sup>3</sup> /rev	16.22	14.69	13.60	2.76	21.38	36.00	
	B12	2.26 in <sup>3</sup> /rev	17.64	16.11	15.02	2.84	23.05	38.92	
P2	B14	2.81 in <sup>3</sup> /rev	21.88	20.35	19.26	3.09	27.99	47.56	
	B17	3.56 in <sup>3</sup> /rev	27.73	26.20	25.11	3.43	34.81	59.51	
	B20	3.89 in <sup>3</sup> /rev	30.34	28.81	27.42	3.58	37.86	64.85	
	B22	4.29 in <sup>3</sup> /rev	33.43	31.90	30.81	3.76	41.47	71.16	
	B25	4.84 in <sup>3</sup> /rev	37.71	36.18	35.09	4.01	46.46	79.90	
	B28	5.42 in <sup>3</sup> /rev	42.23	40.70	39.94 <sup>1)</sup>	4.27	51.74	76.73 <sup>1)</sup>	
	B31	6.10 in <sup>3</sup> /rev	47.56	46.03	45.27 <sup>1)</sup>	4.58	57.95	86.06 <sup>1)</sup>	

<sup>1)</sup> B28 - B31 - B50 = 3000 PSI max. int. 2) B42 - B45 - B50 = 2200 R.P.M. max

<sup>-</sup> Not to use because internal leakage greater than 50% theoretical flow Port connection can be furnished with metric threads.

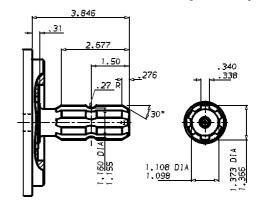
#### **ADDITIONAL SHAFTS - T6 SERIES MOBILE APPLICATION**

## **ADDITIONAL P VERSION**

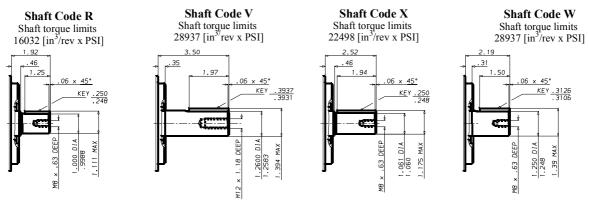


#### ADDITIONAL SHAFT CODE T: 540 RPM POWER TAKE-OFF - SAE J718C FOR FARM TRACTORS

3.25 3.25 1.90 1.5 1.00 27 R 1.108 DIA 27 R 1.098 DIA 27 R 1.098 DIA 1.098 Shaft torque limits
T6CCMW - 28937 [in<sup>3</sup>/rev x PSI]
T6DCMW - 58990 [in<sup>3</sup>/rev x PSI]
T6EM - T6ECM - T6EDM - 63256 [in<sup>3</sup>/rev x PSI]



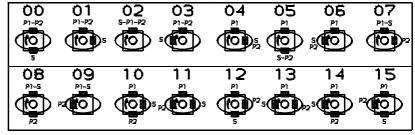
## **ADDITIONAL SPECIAL T6CCMW SHAFTS**



T6CC\* - T6DC\* - T6EC\*

00	<b>01</b>	<b>02</b> 5-P1-P2	03	04	05	05	07
P1-P2	(O) s	(E)	5	P) 5	S-P2		P1-5
98	09 P1-5	10 P1	<b>11</b>	12	13	14	15
P2 P2					- 7//	-	
15	17	18	19	20	21	22	23
P1 P2	P1 5 P2	P2 5	P2 P1 S	5	P1	P1 S	P2 P1
24	25 P1-5	2 <b>5</b>	27	28	29	30	31
P1-5 P2			P2 P1-5		•		

T6ED\*



T6DCCM - T6EDC\*

00	01	02	03	04	05	05	07
P1-P2-P3	P1-P2-P3	5-P1-P2-P3	P1-P2-P3	P1 S	PI	5 P1	P1-5
		(III)	5 (FO)				
5					5-P2-P3		
08	09	10	11	12	13	14	15
P1-5	P1-5	PI	P1-P2	P1-P2	P1-P3	PI	P1-P3
			(E)				
P2-P3		P2-P3	5-P3			P2-P3	
15	17	18	19	20	21	22	23
5-01-02	5-01-02	5-P1-P2	5-91-93	5-01-03	5-01-03	P1-P2	P1
	P3			P2			
24	25	26	27	28	29	30	31
PI PE	PI	P1 P2	P1-P3	P1-5	P1-5	P1-5	P1-5
5	5		5-22	P3	P3	P2	P2
32	33	34	35	36	37	38	39
P1-5	P1-5	P1-P2	P1-P2	P1-P2	P1-P2	P1-P2	P1-P2
			<b>₹([0</b> ])		,4 <b>(6)</b>		
		P3	P3	5	5		
40	41	42	43	44	45	46	47
P1-P3	P1-P3	P1-P3	P1-P3	P1-P3	P1-P3	P1 P2	P1 P2
	\$( <b>E</b> O)						
P2	P2	5	5			P3	
48	49	50	51	52	53	54	55
		PI	P1	. P1	P1	P1	P1
	,,( <b>[O]</b> )5						
P2		S-P2	S-P2	5-P3	S-P3		Р3
55	57	58	59	50	51	52	63
P1	PI	Pi	PI	P1	P1	PI	P1
		p;([O])5				WED.	2 (LOI),
	P2	P2	P3	5	P3	5	P2

## **PORTING DIAGRAMS - T6 SERIES MOBILE APPLICATION**

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